Repair Manual

R 850 C
R 1200 C

Introduction

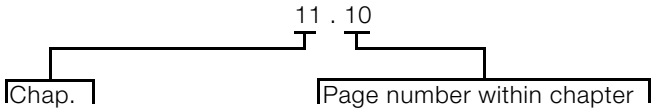
This repair manual will help you to perform all the main maintenance and repair work correctly and efficiently. It should be consulted regularly by workshop personnel as an addition to the practical and theoretical knowledge obtained in Training School courses. It is a contribution towards achieving even higher Service quality.

A new issue of this repair manual will be published if amendments or additions (supplements) are needed. The latest issue date is shown in the header of the microfiche. Microfiches rendered invalid by the new issue should be destroyed without delay.

All information in both text and illustrations refers to motorcycles in standard condition or with Original BMW accessories installed, and not to motorcycles which have been modified in any way to depart from the manufacturer's specification.

- The repair manual is structured in the logical sequence of the work to be performed: Removal, Dismantling, Repair, Assembly, Installation.

- The entire contents are divided into individual chapters, corresponding to the Construction Groups.



- Work to be performed during an Inspection is described in Group 00. The various Inspection routines are numbered I, II, III and IV. This numbering is repeated in the work descriptions which follow, so that work can take place without interruption.

- Use of the BMW special tools needed for certain tasks is described in the work instructions.

If the need arises, repair instructions are also issued in the form of Service Information. This information is of course incorporated into the next issue of the repair manual. We also recommend you to consult the detailed illustrations on the Parts microfiches as an additional source of information.

BMW AG Motorcycle Division
After Sales

BMW AG Motorcycle Division
Maintenance schedule
R 1100 S / R 850/1200 C / R 1150 GS

Customer	Licence plate No.	BMW Inspection at 1000 km (600 miles)	BMW Service every 10000 km (6000 miles)	BMW Inspection every 20000 km (12000 miles)	BMW Annual Service
Order No.	Mechanic's signature				
Read the fault code memory with the MoDiTeC		☐	☐	☐	☐
Change oil while at regular operating temperature and renew the oil filter element **if motorcycle is used only for short journeys or at outside temperatures under 0°C (32 °F), every 3 months, but at least every 3 000 km (1 800 miles) *)**		☐	☐	☐	☐
Change oil in gearbox while at operating temperature **at least every 2 years*)**				☐	☐ every 2 years
Change oil in rear wheel drive while at regular operating temperature; if necessary, clean inductive sensor on rear wheel **every 40 000 km (24 000 miles) or at least every 2 years *)**		☐		☐ 40 000 (24 000)	☐ every 2 years
Renew fuel filter *) **normally every 40 000 km (24 000 miles), if fuel quality is poor every 20000 km (12 000 miles)**				☐ 40 000 (24 000)	
Check battery acid level, if necessary add distilled water Clean and grease the battery terminals, if necessary				☐	☐
Renew intake air filter element **in very dusty or dirty operating conditions, renew the intake air filter element every 10000 km (6 000 miles) or even more often if necessary *)**				☐	
Renew Poly-V belt *) **renew Poly-V belt every 60 000 km (36 000 miles); do not adjust**				☐ 60 000 (36 000)	
Check brake fluid level at front and rear and top up if necessary *)		☐	☐	☐	
Check operation of brake system and freedom from leaks; repair/replace items if nec. *)				☐	
Examine brake pads and discs for wear, renew if necessary *)			☐	☐	
Change the brake fluid annually					☐
Check clutch fluid level		☐	☐	☐	
Change the clutch fluid **every 40 000 km (24 000 miles) or at least every 2 years *)**				☐ 40 000 (24 000)	☐ every 2 years
Check tightness of rear wheel studs		☐			
Check rear wheel bearing play by tilting wheel				☐	
Check swinging arm bearings (zero play); adjust if necessary *)		☐		☐	
Grease the side stand pivot		☐	☐	☐	
Check function of side stand contact switch		☐	☐	☐	☐
Check condition of spark plugs			☐		
Renew spark plugs *)				☐	
Check security of cylinder head nuts		☐			
Check/adjust valve clearances		☐	☐	☐	
Check throttle cable for free movement, abrasion and kinking; renew if necessary *) Check cable play Check synchronisation and eliminate leaks *)		☐	☐	☐	
Final inspection with road safety and functional check: – Condition of tyres and wheels, rims and spokes if applicable, tyre pressures – Lights and signalling equipment – Telltale and warning lights – Clutch, gear shift – Front and rear brakes, steering – Instruments – If necessary, test ride		☐	☐	☐	☐

***) Charged as an additional item**

BMW AG Motorcycle Division
Pre-delivery check
R 1100 S / R 850/1200 C / R 1150 GS

Customer _____ Licence plate No. _____ Order No. _____ Mechanic's signature _____	**BMW** **Pre-delivery check**
Check the shipping crate for damage	☐
Motorcycle: – unpack – install remaining items – inspect for damage – check that delivery is complete: tools, documentation, keys, correct optional extras	☐
Fill and charge the battery (mark with charging date)	☐
Check engine oil level when cold; add oil if necessary	☐
Check clutch operating fluid level and brake fluid levels at front and rear	☐
Check headlight beam angle, adjust if necessary	☐
Check security of rear wheel studs (comply with correct tightening torque)	☐
Check tyre pressures	☐
Fill fuel tank	☐
Final inspection as functional check: – Clutch, gear shift – Front and rear brakes – Lights and signalling equipment, telltale and warning lights, instruments – Check operation of optional extras, ABS – If necessary, test ride	☐
Confirm pre-delivery check in Service and Technical Booklet	☐
Final cleaning	☐
Motorcycle handed over on:	

Order No. 01 71 0 008 872 UX-VS-2, 06.99 Printed in Germany

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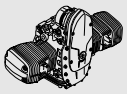

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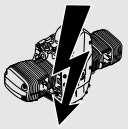

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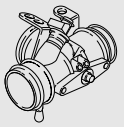

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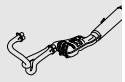

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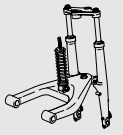

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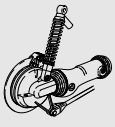

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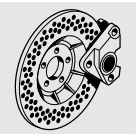

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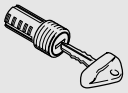

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00 Maintenance and general instructions

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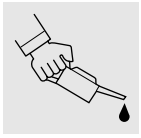

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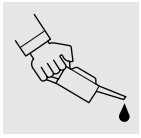
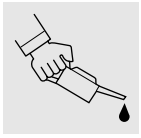
Tightening torques

Model	R 850/1200 C
Connection	**Nm**
11 Engine	
Cylinder head	
Tightening sequence: 1. Tighten cylinder head nuts (oiled) crosswise 1.1 Tighten all nuts to correct torque for joint 1.2 Tighten all nuts to correct angle 90° 1.3 Tighten all nuts to correct angle 90° 2. M 10 bolt 3. M 6 screw	 20 40 9
After 1000 km (600 miles), tighten cylinder head nuts crosswise: 1. Unfasten one nut 2. Tighten one nut to initial value 3. Tighten nut to wrench angle 180° 4. Unfasten/retighten M10 screw	 20 40
Timing gear carrier to cylinder head	9
Bearing cap on rocker shaft	15
Locknut, valve adjusting screw	8
Cylinder head cover to cylinder head	9
Camshaft end cover to cylinder head	9
Air intake connection to cylinder head	9
Camshaft	
Chain sprocket to camshaft	65
Camshaft bearing cap	15
Rotary breather	
Vent line to alternator mount cover	
M 8 screw	20
Banjo screw	25
Alternator mount cover	
M 6 screw	9
M 8 screw	20
Auxiliary shaft	
Chain sprocket to crankshaft	10
Chainwheel to auxiliary shaft	70
Chain tensioner housing to engine block	9



Model		R 850/1200 C
Connection		**Nm**
11 Engine		
Oil filter		
Oil filter		11
Oil drain plug		32
Oil pump		
Mesh filter basket to engine block		9
Oil pump cover		9
Pressure relief valve		35
Oil pressure switch		30
Oil cooler		
Oil cooler pipe to engine block		10
Cooling oil line - banjo screw with oil vent valve		25
Oil cooler to frame		9
Oil cooler return line to engine block		35
Screw-in union for oil cooler connection at engine block		35 (clean threads and apply Loctite 603 to inner and outer threads and in the contact face area)
Cylinders		
Tightening sequence:		
1. M 8 screw		20
2. M 6 screw		9
3. Chain guide rail pivot screw		18
Timing chain		
Chain tensioner		32
Connecting rod		
Big end cap	Joint torque	20
	Additional wrench angle	80°
Crankcase		
Tightening sequence:		
1. M10 screw (oiled)		45
2. M 8 screw (oiled)		20
3. M 6 screw		9

Model		R 850/1200 C
Connection		**Nm**
12 Engine electrics		
Starter motor to engine		20
Starter cover to housing		7
Positive lead to starter motor		10
Alternator to cover mount		20
Tensioning and retaining strap at alternator		20
Spacer at alternator		20
Positive lead to alternator		15
Belt pulley at alternator		50
Belt pulley to crankshaft		50
Poly-V belt preload		8
Spark plug		20
Ignition coil holder to frame		9
13 Fuel preparation and control		
Oil temperature sensor to engine block		25
Air temperature sensor to air cleaner cover		10
16 Fuel tank and lines		
Fuel tank to rear frame		10
18 Exhaust system		
Manifold to cylinder head		24
Clip on muffler		55 (apply Never Seez to clip contact surface)
Oxygen sensor (lambda probe) to muffler		45 (apply Never Seez to thread)
21 Clutch		
Clutch housing	Joint torque	40 (oil screw threads lightly)
	Additional wrench angle 32°	
Housing cover		12
Slave cylinder to gearbox		9
Clutch line to handlebar fitting		18



Model		R 850/1200 C
Connection		**Nm**
23 Transmission		
Oil filler plug		23
Oil drain plug		55
Gearbox to engine block		22
Gear shift pedal to rear frame		41
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Gearbox cover to gearbox housing		9
31 Front fork		
Fixed tube to fork bridge		35 (free from oil and grease)
Slider tube bridge to slider tube		22 (clean thread + Loctite 243)
Quick-release axle clamp screws		20
Threaded journal to frame		130 (clean thread + Loctite 243)
Ball joint to fork slider bridge		230 (apply light coat of Never Seez to thread)
Leading link to ball joint		130 (clean thread + Loctite 2701)
Leading link to engine	right	73
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Handlebar at fork bridge		21 (apply light coat of Never Seez to thread)
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33 Rear wheel drive		
Oil filler plug		23
Oil drain plug		23
Threaded ring		118 (Hylomar SQ 32 M)
Hexagon nut, input bevel gear		200 (clean thread + Loctite 2701)
Cover at rear-wheel drive housing		35
Rear-wheel drive to swinging arm		24
Swinging arm bearing journal to rear frame	right	9
Swinging arm bearing journal to rear frame	left	7 (clean thread + Loctite 2701)
Locknut at swinging arm bearing journal		160
Suspension strut to rear frame		50
Suspension strut to rear swinging arm		50

Model	R 850/1200 C
Connection	**Nm**
34 Brakes	
Brake caliper at fork slider tube	40
Brake caliper to rear wheel drive	40
Brake disc to front wheel	24 (clean thread + Loctite 2701)
34 Brakes	
Brake disc to rear wheel drive	21 (clean thread + Loctite 2701)
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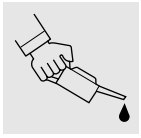

Model	R 850/1200 C
Connection	**Nm**
46 Frame	
Frame to engine	
M12 pin	82
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Rear frame	
to engine	41
to gearbox	71
Side (prop) stand pivot mount to engine	21
Side (prop) stand to pivot mount	42 (clean thread + Loctite 243)
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Pillion seat mount	21
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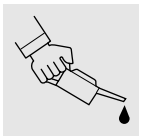
Horn to holder	13
Ground (earth) strap to engine block	10
63 Lights	
Headlight to holder	15

Table of operating fluids

Item	Use	Order number	Quantity
Lubricant			
Optimoly MP 3	High-performance lubricating paste	07 55 9 062 476	100 g tube
Optimoly TA	High-temperature assembly paste	18 21 9 062 599	100 g tube
Silicone grease 300, heavy	Damping grease	07 58 9 058 193	10 g tube
Retinax EP2	Wheel, steering head and taper roller bearing grease	83 22 9 407 845	100 g tube
Contact spray	Contact spray	81 22 9 400 208	300 ml aerosol
Chain spray	Drive chain	72 60 2 316 676 72 60 2 316 667	50 ml spray 300 ml spray
Sealants			
3-Bond 1110 B	Surface sealant	07 58 9 056 998	5 g tube
3-Bond 1209	Surface sealant	07 58 9 062 376	30 g tube
omni VISC 1002	Surface sealant	07 58 1 465 170	90 g tube
Loctite 574	Surface sealant	81 22 9 407 301	50 ml tube
Curil K 2	Heat-conductive sealant	81 22 9 400 243	250 g can
Hylomar SQ 32 M	Permanently elastic sealant	81 22 9 400 339	100 g tube
Adhesives and retaining agents			
Loctite 648	Joint adhesive (low clearance)	07 58 9 067 732	5 g bottle
Loctite 638	Joint adhesive (greater clearance)	07 58 9 056 030	10 ml bottle
Loctite 243	Thread retainer, medium-strength	07 58 9 056 031	10 ml bottle
Loctite 270	Thread retainer, strong	81 22 9 400 086	10 ml bottle
Loctite 2701	Thread retainer, strong	33 17 2 331 095	10 ml bottle
Loctite 454	Cyanacrylate adhesive (gel)	07 58 9 062 157	20 g tube
Cleaner			
Brake cleaner	Brake cleaner	83 11 9 407 848	600 ml aerosol
Metal Polish	Polish for chromium plated parts	82 14 9 400 890	100 g tube
Testing agent			
Penetrant MR 68	Crack testing agent for aluminum housings	83 19 9 407 855	500 ml spray
Entwickler MR 70	Crack testing agent for aluminum housings	81 22 9 407 495	500 ml spray



Key to maintenance intervals

- BMW Inspection 1000 km/600 miles **I**
- BMW Service **II**
- BMW Inspection **III**
- BMW Annual Service **IV**

Reading out MoDiTeC fault memory

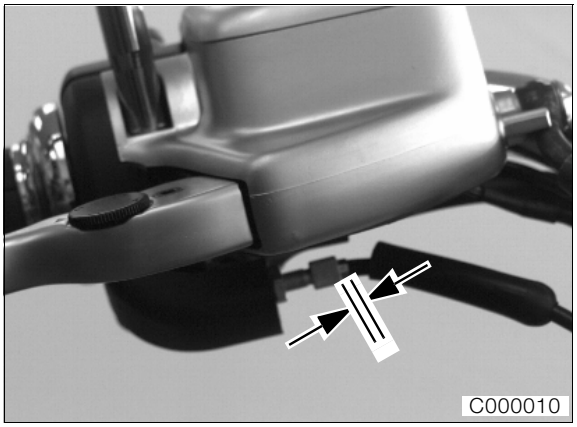
(Inspections I, II, III and IV)

- Remove the left air cleaner trim panel.
- Connect MoDiTeC to diagnostic plug.
- Read out the fault memory.
- Perform any repair work indicated.

Checking throttle cable play, adjusting if necessary

(Inspections I and III)

- Check throttle cable for free movement and freedom from abrasion or kinking; renew if necessary.
- With the steering turned to various angles, open the throttle twistgrip fully and allow it to close again.
- When released, the twistgrip must return to the closed position by itself.



- Pull back the protective cap.
- Preset throttle cable play with the engine cold to 1.5 mm (0.06 in).
- Warm the engine up to its regular operating temperature.
- Adjust throttle cable play to 0.5 mm (0.02 in).

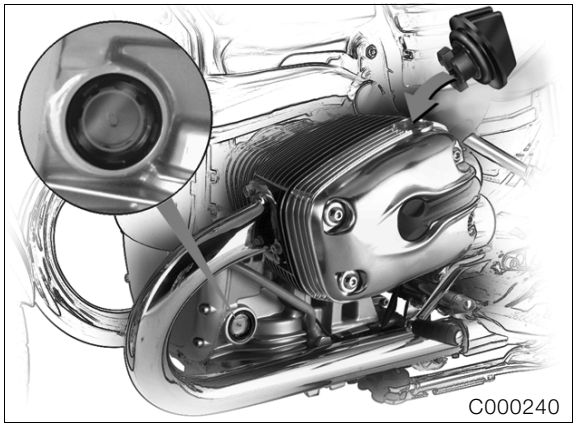
Adjusting value:
Initial throttle cable play setting
(engine cold) ..... 1.5 mm (0.06 in)
Throttle cable play (engine warm).. 0.5 mm (0.02 in)

Changing engine oil, renew oil filter element

(Inspections I, II, III and IV)

Note:
If the motorcycle is ridden only for short distances or outside temperatures are below 0°C (32°F): change the oil and renew the oil filter element every 3 months, but at least every 3 000 km (1 800 miles).

- Change the oil while it is at regular operating temperature.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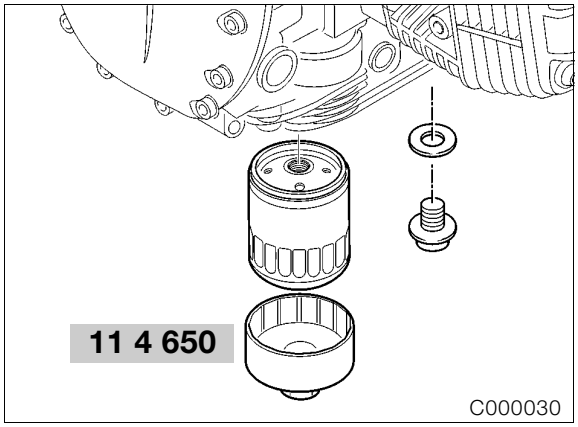
- Remove screw plug.
- Unscrew oil drain plug and drain off oil.
- Fit new seal and screw in drain plug.



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- Use oil filter wrench, **BMW No. 11 4 650**, to unscrew and remove the oil filter.
- Coat sealing ring on new oil filter element with oil and screw in.
- Add oil.
- Insert and tighten the screw plug.
- Check engine oil level with the motorcycle in a horizontal position; use the auxiliary stand, **BMW No. 00 1 550**.

Caution:
Never add engine oil above the MAX mark.

Tightening torque:
Oil filter..... 11 Nm
Oil drain plug..... 32 Nm

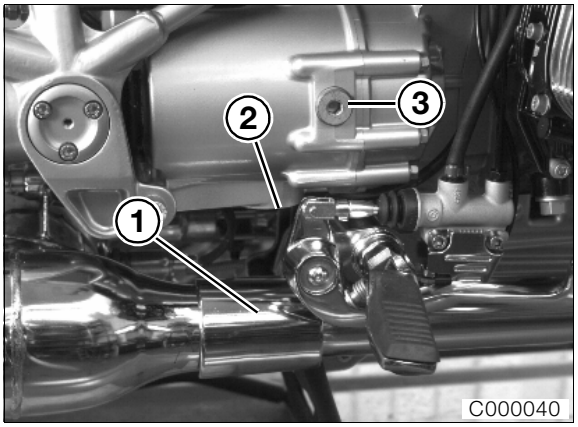
Fill quantity for engine:
With oil
filter change .. 3.75 l (6.6 Imp. pints/3.96 US quarts)
Without oil
filter change .. 3.50 l (6.2 Imp. pints/3.69 US quarts)
Oil volume between MIN and
MAX marks.....0.50 l (0.88 Imp. pint/0.52 US quart)

Engine oil grade:
Brand-name HD oil for four-stroke spark-ignition engine, API classifications SE, SF, SG; combination with CC or CD specification.

Changing oil in gearbox

(Inspections III and IV)
or at least every 2 years

- Change the gearbox oil while at regular operating temperature.



- Loosen clip/trim (1) at right silencer and turn downwards.
- Take out oil filler plug (3) and oil drain plug (2) and allow the oil to drain out.
- Clean the magnet in the oil drain plug.
- Insert the oil drain plug again.

Note:
Add oil to the gearbox up to the lower edge of the filler hole, then place the motorcycle on its side (prop) stand and add the remaining 0.2 litre (0.35 Imp. pint, 0.21 US quart).

- Add gearbox oil.
- Insert oil filler plug with new seal.

Tightening torque:
Oil drain plug..... 55 Nm
Oil filler plug ..... 23 Nm
Exhaust pipe clip at silencer (muffler) ..... 55 Nm

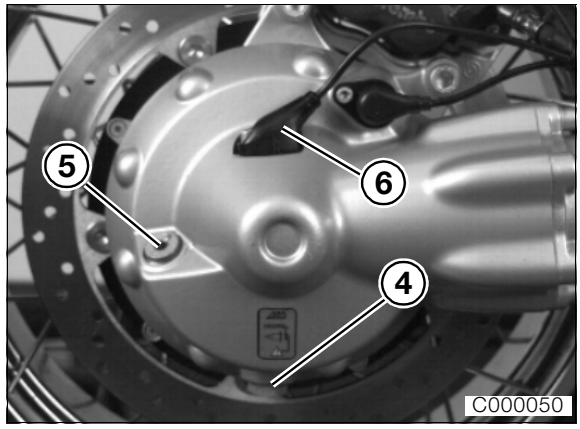
Fill quantity:
Initial filling.....1.0 l (1.76 Imp. pints/1.06 US quart)
During
oil changes.....1.0 l (1.76 Imp. pints/1.06 US quart)

Oil grade for gearbox:
Brand-name hypoid gear oil, SAE 90, API class GL 5

Changing oil in rear wheel drive; cleaning inductive signal transmitter at rear wheel

(Inspections I, III and IV)
Every 40 000 km (24 000 miles) or at least every 2 years

- Change the gearbox oil while at regular operating temperature.



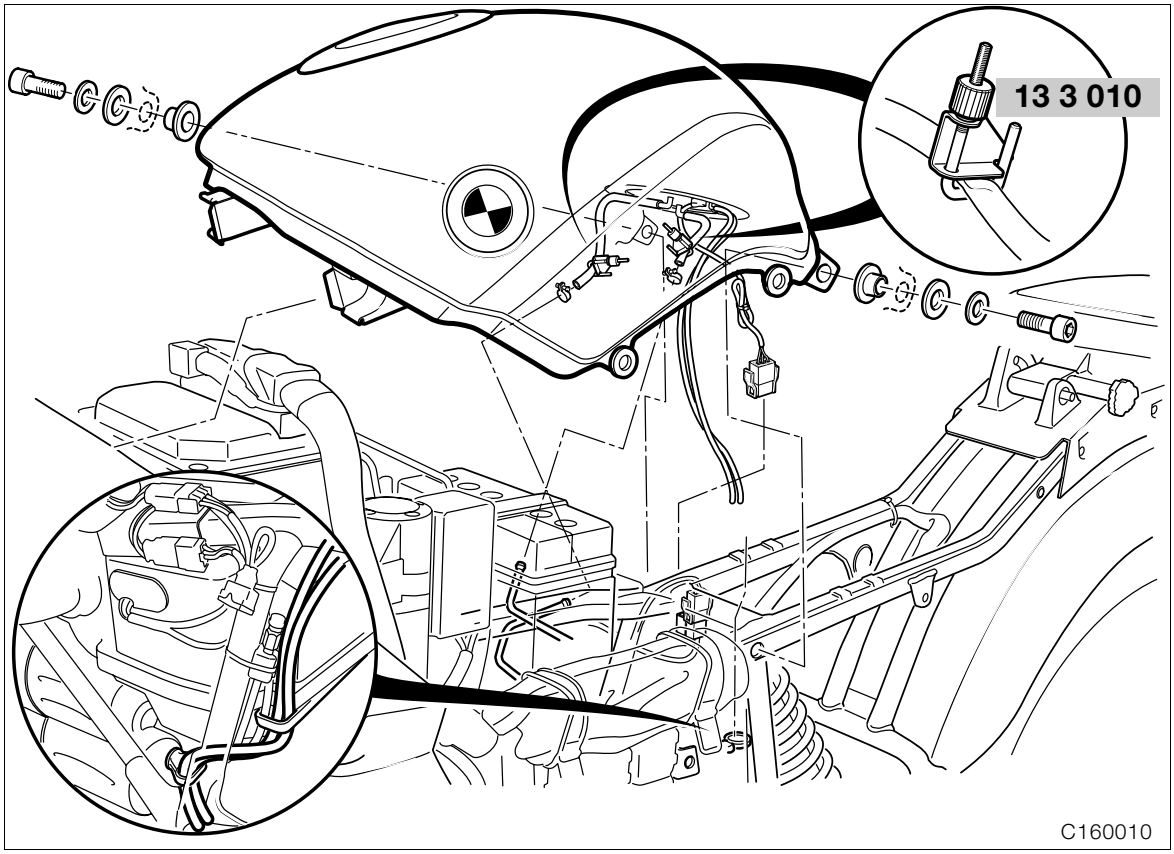
Caution:
Note that the interior of the gearbox is slightly pressurised.

- Slacken off oil drain plug (4) so that the pressure drops.
- Unscrew and remove oil filler plug (5).
- Unscrew and remove oil drain plug (4) and allow the oil to drain out.
- Fit new seal and screw in drain plug.
- Add gearbox oil.
- Insert oil filler plug with new seal.
- Release the fastening, pull out inductive signal transmitter (6) and clean it.

Tightening torque:
Oil drain plug..... 23 Nm
Oil filler plug ..... 23 Nm

Fill quantity:
Initial filling up to lower edge of filler hole.....app. 0.20 l (0.35 Imp. pint/0.21 US quart)
Oil change up to lower edge of filler hole.....app. 0.20 l (0.35 Imp. pint/0.21 US quart)

Oil grade for rear wheel drive:
Brand-name hypoid gear oil, SAE 90, API class GL 5



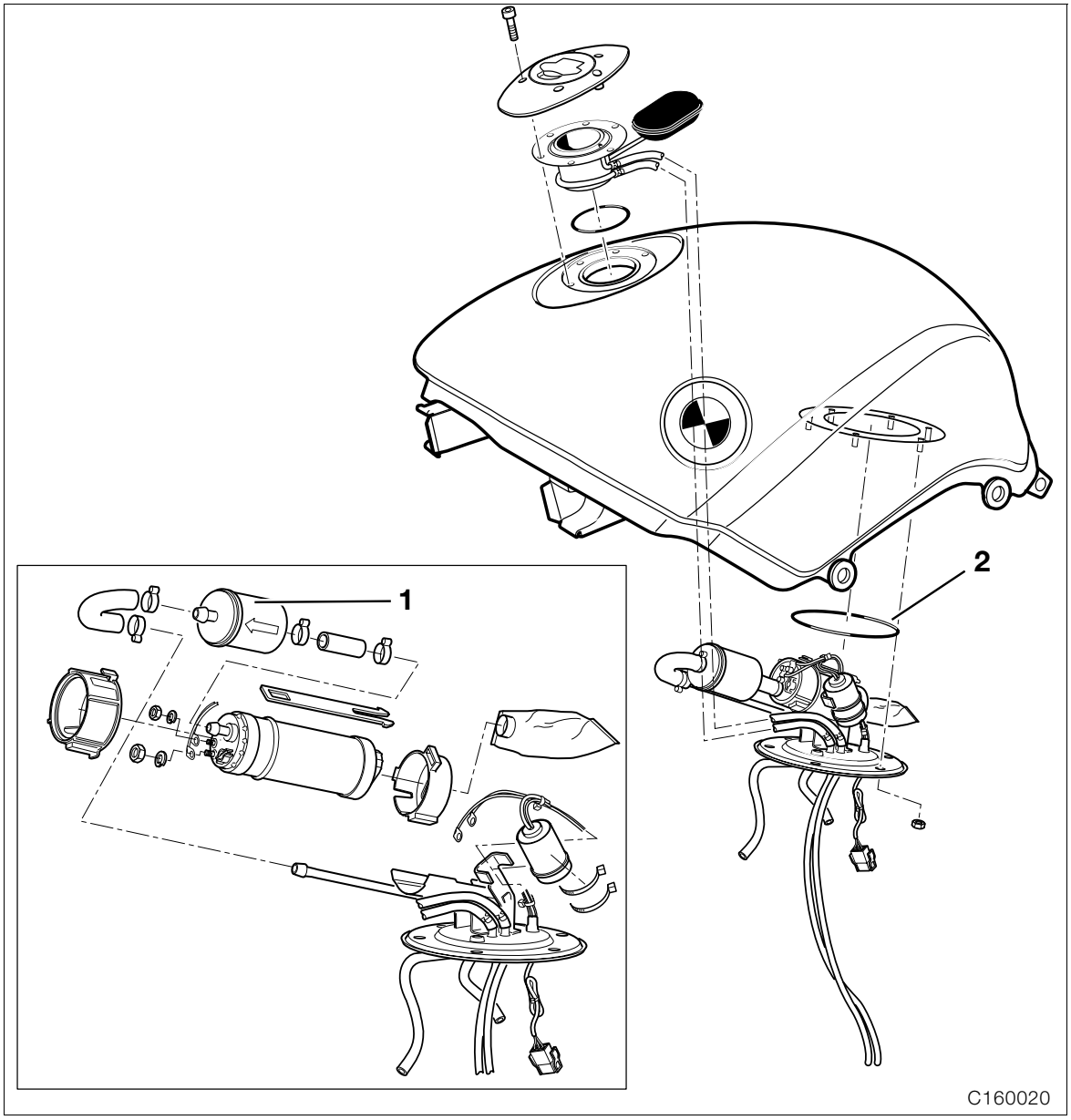
Renewing fuel filter

(Inspection III)
In normal operating conditions every 40 000 km (24 000 miles); if fuel quality is poor every 20 000 km (12 000 miles)

- Remove seat.
- Remove right air cleaner trim panel.
- Remove left and right trim panels.

⚠ Caution:
Fuel is flammable and a hazard to health. Observe relevant safety regulations.

- Take off the fuel tank.
- Seal the fuel feed and return lines with a hose clip, **BMW No. 13 3 010**, detach and pull off.
- Pull the plug connector off the fuel pump assembly.
- Lift off fuel tank.



- Drain fuel tank.
- Remove fuel pump assembly.
- Detach hoses from fuel filter (1).

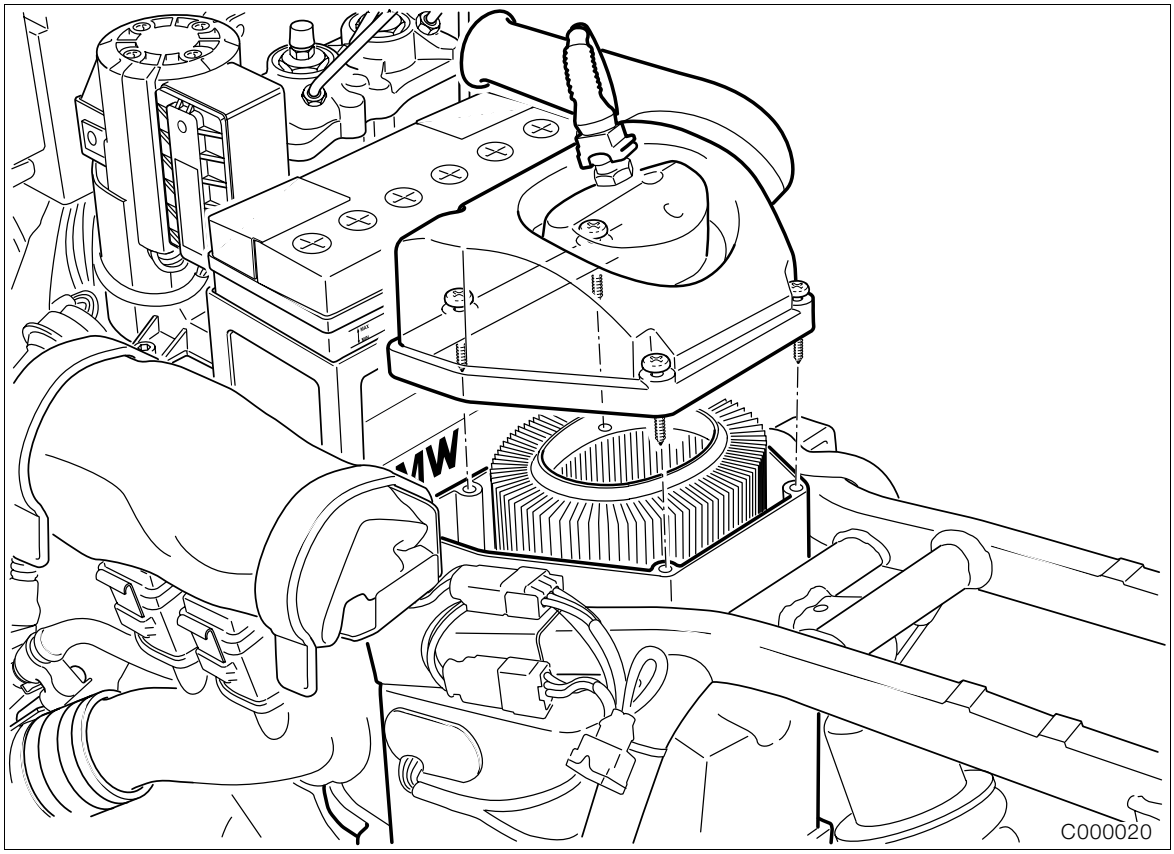
Caution:
Note correct direction of flow through fuel filter.
Use only an O-ring seal (2) in good condition.
After installing, check fuel pump assembly for leaks.

- Fit new fuel filter.
- Secure non-reusable hose clips with pliers, **BMW No. 13 1 500**.

Tightening torque:
Fuel pump unit ..... 5 Nm

Installing:

Note:
Note correct path of vent lines.



Checking battery acid level/topping up if necessary, cleaning/greasing battery posts

(Inspections III and IV)

- Release the rubber strap holding the battery.
- Raise the battery and check its acid level.
- Top up battery acid level with distilled water as far as the MAX mark.

Protective
battery-post grease: .....e.g. Bosch Ft 40 V1

Renewing intake air cleaner element

(Inspection III)
In very dirty and dusty operating conditions, renew every 10 000 km (6 000 miles) or even more frequently if necessary

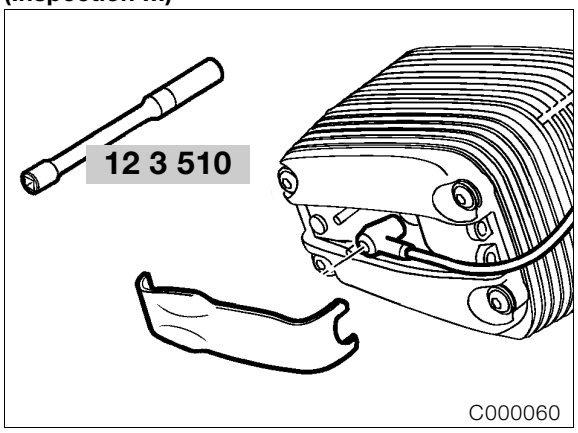
- Detach and raise the upper part of the air cleaner housing.
- Renew air cleaner element.
- Install the fuel tank.
- Note correct path of vent lines.
- Install the left/right trim panels.

Tightening torque:
Fuel tank to rear frame ..... 10 Nm

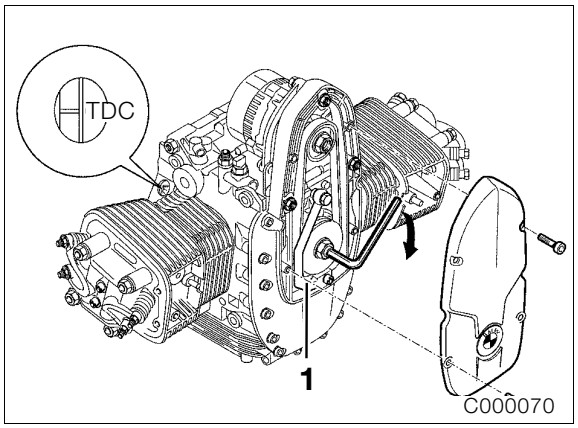
Renewing Poly-V belt

(every 60 000 km/36 000 miles)

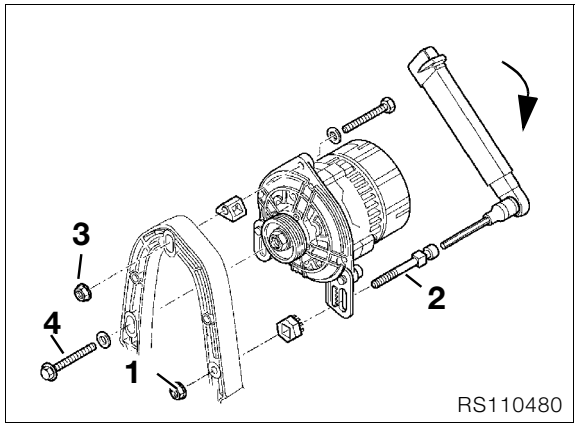
(Inspection III)



- Remove the cover.
- Use the spark plug cap assembly tool from the toolkit to pull off the spark plug caps.
- Use spark plug wrench, **BMW No. 12 3 510**, to unscrew and remove the spark plugs.



- Remove the horn with its mount.
- Remove front cover.
- Remove vent line (1).



- Slacken off alternator mounting screws (1,3,4) and install a new Poly-V belt if necessary.

Poly-V belt adjusting procedure:
Poly-V belt installation procedure:

- Place the Poly-V belt in position, tension it and turn the engine over once, then release belt tension.

Poly-V belt tensioning procedure:

1. Screw hex nut (1) on adjusting screw (2) up handtight (**no tools to be used**)
2. Tighten adjusting screw (2) with a torque wrench and keep it under tension.
3. Tighten upper retaining nut (3), then release the tension at the adjusting screw.
4. Tighten all screws and nuts.

Tightening torque:

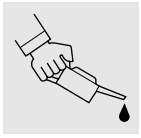
Poly-V belt preload	8 Nm
Alternator to alternator support cover	20 Nm
Vent line at generator mount cover:	
Banjo screw	25 Nm
Machine screw	10 Nm

Caution:
Install the vent line with new O-ring seals.

Checking brake system for correct operation and freedom from leaks; repairing/renewing if necessary

(Inspection III)

- Checking brake system for leaks.



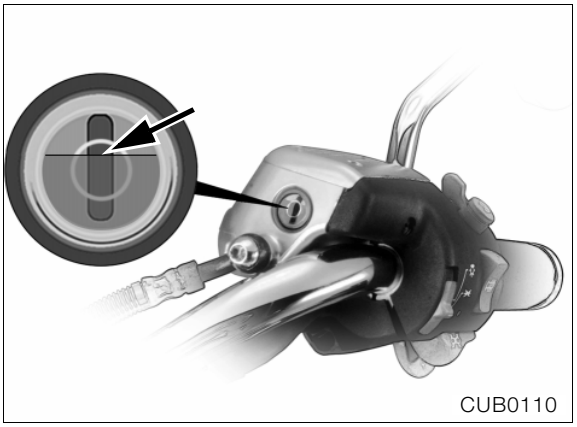
Checking brake fluid level

Note:
The brake fluid volume (between MIN and MAX) is sufficient for the complete range of pad wear from new to the wear limit.
It is not normally necessary to add fluid to compensate for pad wear.
If the level drops below the minimum mark, this indicates some other fault.

(Inspections I, II and III)

Front brake

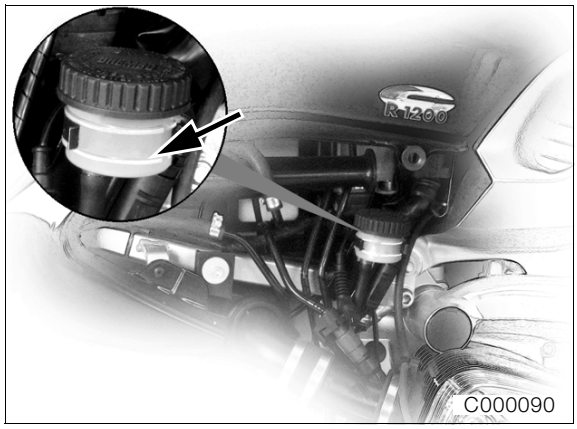
- Make sure that the specified setting (distance between handlebar and fuel tank 30-50 mm/ 1.2-2 in) is correct.
- Check with the motorcycle on its side (prop) stand.
- Turn the handlebar fully to the left.
- The brake fluid must not drop below the minimum level 2 mm (0.08 in) below the ring mark (arrow).



Brake fluid grade .....DOT 4

Rear brake

- Position the motorcycle horizontally with auxiliary stand, **BMW No. 00 1 550**.
- Brake fluid must not drop below the minimum level (arrow).

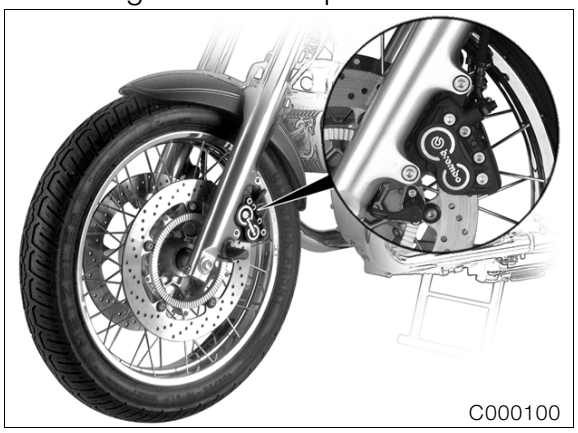


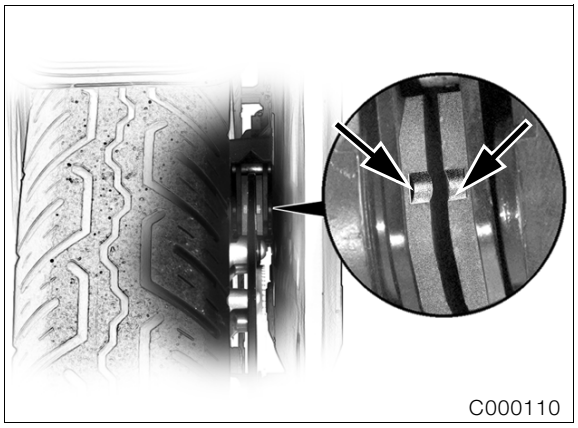
Brake fluid grade .....DOT 4

Checking brake pads and discs for wear/renewing

(Inspections II and III)

Checking front brake pad wear


C000100

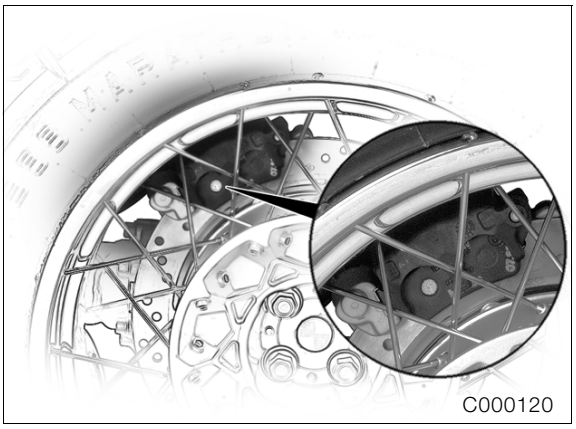

C000110

- Examine the wear limit marks (arrows).

⚠ Caution:
Brake pad thickness must not fall below the minimum value.
Change pads only as a complete set.

Minimum lining thickness: ..... 1.5 mm (0.06 in)

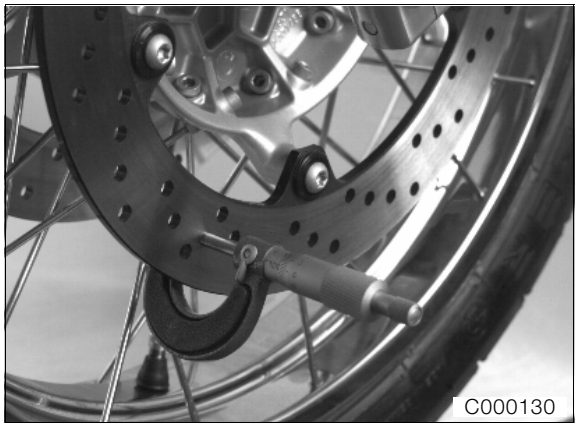
Checking rear brake pad wear


C000120

It should not be possible to see the brake disc through the hole (arrow) in the inner brake pad.

If the brake disc is visible, the wear limit has been reached and the pads must be renewed.

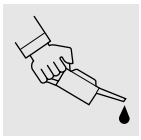
Checking brake disc wear

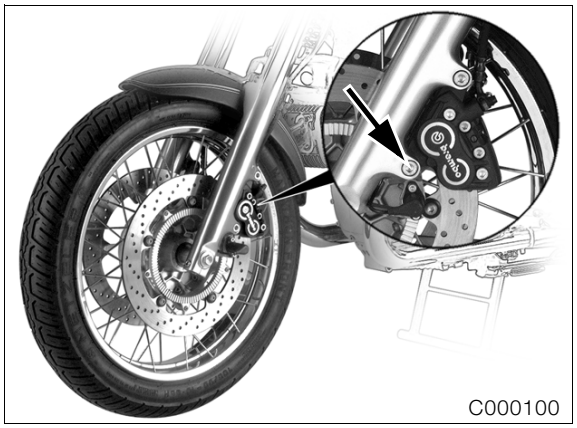

C000130

- Examine the brake discs carefully for cracks, damage, distortion, wear and score-marks.

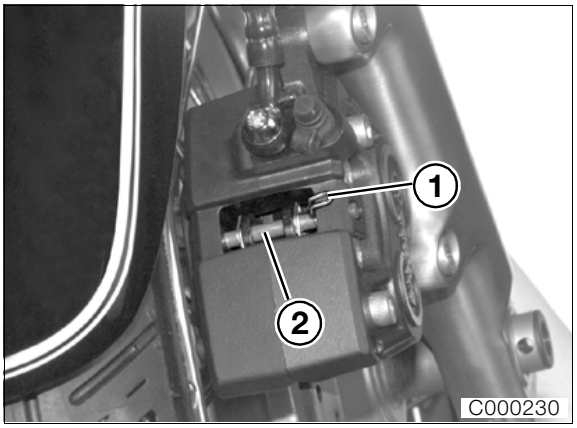
Brake disc wear limit:
front:..... 4.5 mm (0.177 in)
rear:..... 4.6 mm (0.181 in)

Renewing brake pads Front brake





- Detach/remove brake caliper from mounting (arrow).



- Remove the split-pin keeper (1) from the retaining pin (2).
- Drive out retaining pin (2).
- Remove brake pads by pulling downwards.
- Install by following the above work instructions in the reverse order.
- Before installing the brake caliper, force the pistons fully back with resetting tool, **BMW No. 34 1 500**.

Tightening torque:

Brake caliper at fork slider tube..... 40 Nm

Renewing brake pads Rear brake

- Loosen the rear wheel.
- Unfasten/remove brake caliper.
- Remove circlip (arrow) at retaining pin.
- Drive the retaining pin out towards the wheel side.
- Remove brake pads.
- Install by following the above work instructions in the reverse order.
- Before installing the brake caliper, depress the piston fully.

Tightening torque:

Brake caliper to rear wheel drive..... 40 Nm
Screw the rear wheel studs in handtight, then tighten them in a crosswise pattern.
Initial tightening..... 50 Nm
Final tightening..... 105 Nm

Renewing brake fluid and bleeding brake system

Renew the brake fluid annually (Inspection IV)

[ABS Inspection II and III]

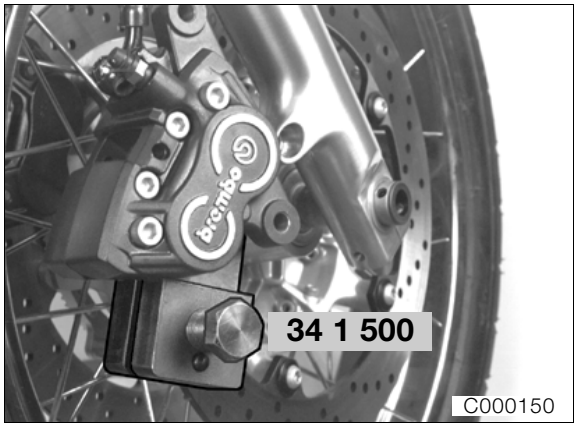
Bleeding front brake circuit/renewing brake fluid

Note:
This description applies to brake filling and bleeding devices with vacuum extraction of the brake fluid at the brake caliper.
If other devices are used, comply with their manufacturers' instructions.

- Turn the steering to the left.

Caution:
When bleeding the brakes, always start on the **right** side.

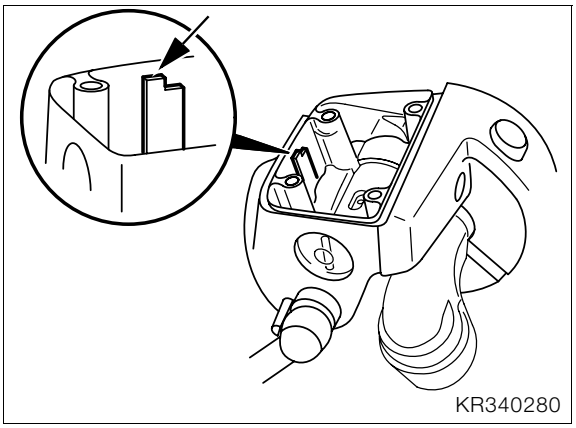
- Take off the brake caliper.
- Remove the brake pads.



- Force the pistons fully back with resetting tool, **BMW No. 34 1 500**.

Caution:
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

- Take off reservoir cover with rubber diaphragm.
- Release the right handlebar switch.
- Loosen the clamp screw for the handbrake fitting and turn the fitting until the brake fluid reservoir is horizontal.



Caution:
When adding brake fluid, do not allow it to enter the holes for the reservoir lid screws.

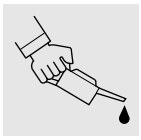
- Add brake fluid up to the MAX mark (arrow).
- Connect the brake bleeding device to the bleed screw on the **right** brake caliper.
- Open the bleed screw by half a turn.
- Draw off brake fluid until it emerges clear and free from air bubbles.
- Close the bleed screw on the right brake caliper.
- Repeat the bleeding process at the left brake caliper.

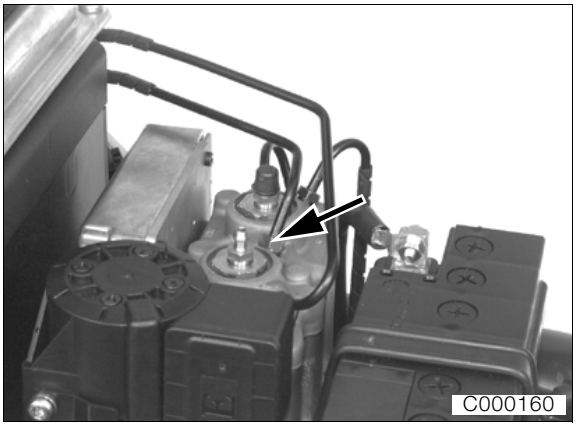
When installing:

Note:
Clean the rim of the reservoir, the rubber gaiter and the cover to remove brake fluid, and re-assemble the components with great care.

Next check brake fluid level with the motorcycle on its side (prop) stand and the handlebar turned to the left, and ensure that no air bubbles are visible in the sight glass.

Additionally with [ABS]





- Connect the brake bleeding device to the pressure modulator for the **front brake** (arrow); this is marked **VR**.
- Open the bleed screw by half a turn.
- Draw off brake fluid until it emerges clear and free from air bubbles.
- Close the bleed screw.
- Bleed the **left** brake caliper in precisely the same way as on the right.
- If necessary, repeat the brake bleeding procedure at the right/left.

Tightening torque:
Bleed screw on pressure modulator ..... 9 Nm

- Take out the resetting tool and insert spacer, **BMW No. 34 1 520**, in its place.
- Press the pistons back in the second brake caliper, but do not remove the resetting tool.
- Fill and bleed the front brake circuit.
- Installation takes place in the reverse order of removal.

Brake fluid grade .....DOT 4

Tightening torque:
Brake caliper to fork tube ..... 40 Nm
Bleed screw at brake caliper ..... 7 Nm

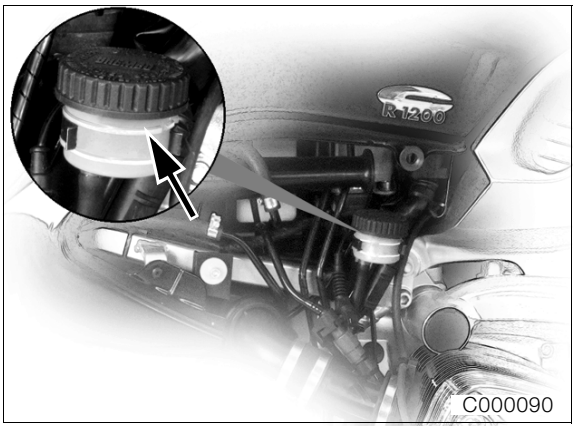
Bleeding rear brake circuit/renewing brake fluid

Note:
On motorcycles with ABS, start at the pressure modulator.

- Use the auxiliary stand, **BMW No. 00 1 550**.
- Loosen the rear wheel studs.
- Remove the cover for the line at the swinging arm.
- Take off the brake caliper.
- Remove the inner brake pad.

Caution:
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

- Move the brake caliper to a horizontal position.
- Connect the bleed line and open the bleed screw.
- Force the pistons fully back with resetting tool, **BMW No. 34 1 500**.
- Press the brake pedal down several times until brake pressure is felt to build up.
- Fill the rear brake circuit and bleed it.
- Take off the reservoir cover.



- Add brake fluid up to the MAX mark (arrow).
- Connect the brake bleeding device to the bleed screw on the brake caliper.
- Open the bleed screw by half a turn.

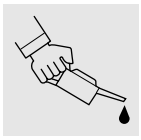
Caution:
During brake bleeding, make sure that the fluid replenishing hole is always below the level of the brake fluid, or else air will be drawn into the brake system. If this occurs, repeat the bleeding operation.

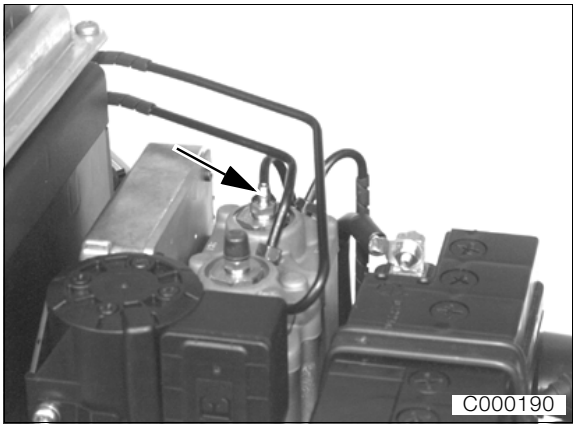
- Draw off brake fluid until it emerges clear and free from air bubbles.
- Close the bleed screw.
- Installation takes place in the reverse order of removal.

Tightening torque:

Brake caliper to rear wheel drive	40 Nm
Rear wheel to rear wheel drive	
Initial tightening	50 Nm
Final tightening	105 Nm
Bleed screw at brake caliper	4 Nm

Additionally with [ABS]





- Connect the brake bleeding device to the bleed screw on the pressure modulator for the **rear brake** (arrow); this is marked **HR**.
- Open the bleed screw by half a turn.

Caution:
During brake bleeding, make sure that the fluid replenishing hole is always below the level of the brake fluid, or else air will be drawn into the brake system. If this occurs, repeat the bleeding operation.

- Draw off brake fluid until it emerges clear and free from air bubbles.
- Close the bleed screw.
- If necessary, repeat the bleeding procedure.

Brake fluid grade .....DOT 4

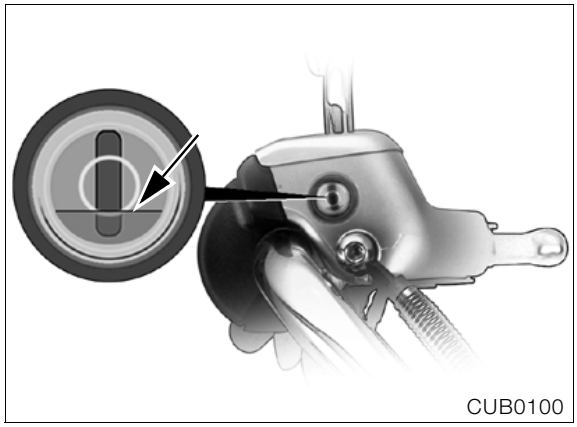
Tightening torque:
Bleed screw at pressure modulator..... 9 Nm

Checking clutch operating fluid level

(Inspections I, II and III)

Caution:
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 550**.
- Turn the steering to the right.



Caution:
With the clutch lining in new condition the surface of the fluid (arrow) must be up to the lower edge of the ring mark; it must **not be below** normal.

Note:
As the clutch lining wears, the fluid level in the reservoir rises.

- If necessary, take off reservoir cover with insert.
- Correct the fluid level. Mark in reservoir: as for brake circuit.
- Re-attach the reservoir cover with insert.
- Tighten the reservoir cover without using force.

Brake fluid grade .....DOT 4

Checking tightness of rear wheel studs

(Inspection I)

- Tighten the rear wheel studs with a torque wrench.

Tightening torque:
Rear wheel studs ..... 105 Nm

Checking rear wheel bearing play by tilting wheel

(Inspection III)

- Tilt the rear wheel to and fro across its axle.
- If play is detected, fit new shims to rear wheel drive or renew bearings.

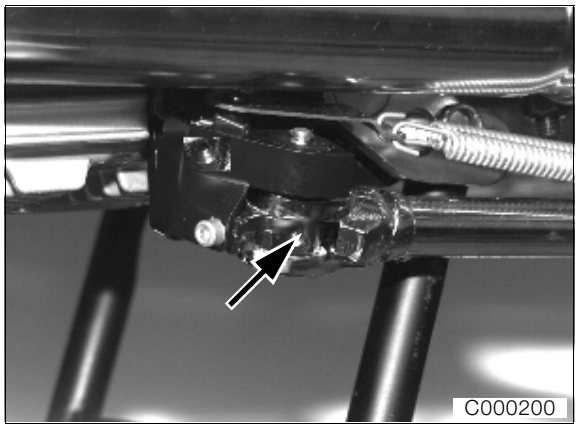
Checking swinging arm bearings, adjusting if necessary

(Inspections I and III)

- Grip rear tyre and try to move it sideways, bracing against the frame.

Greasing the side (prop) stand pivot

(Inspections I, II and III)



- Check free movement of side (prop) stand and grease if necessary.
- Grease pivot point (arrow).

Lubricant:
For side (prop) stand pivot..... Shell Retinax EP2

Checking function of side (prop) stand contact switch

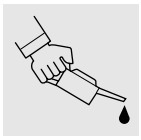
(Inspections I, II, III and IV)

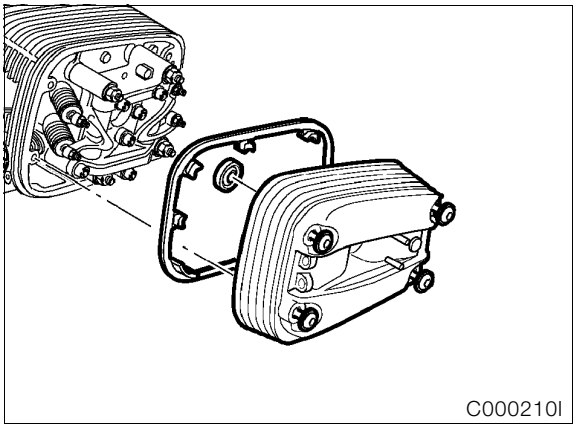
- Place the motorcycle on the auxiliary stand, **BMW No. 00 1 550**.
- Select a gear and switch on the ignition.
- Slowly extend the side (prop) stand and watch the neutral indicator light.

Note:
As the stand is extended, the neutral indicator light should come on briefly.

Tightening cylinder heads

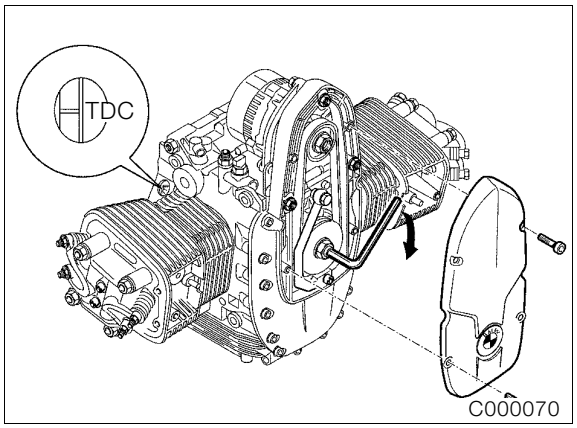
(Inspection I)





- Remove cylinder head cover.

Caution:
Trap escaping oil.



- Select a gear and turn the rear wheel, or set the piston to TDC on the ignition stroke by turning the belt pulley.

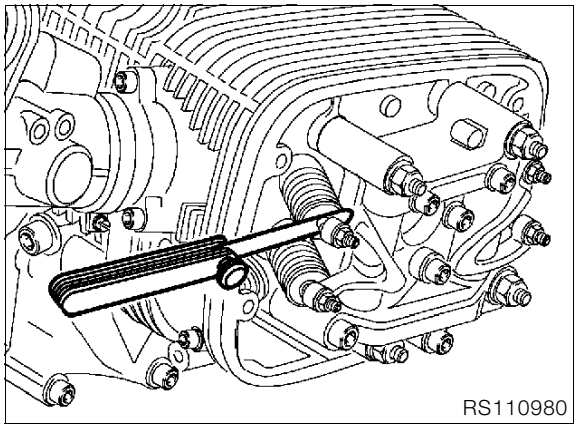
Top dead centre on ignition stroke:
- The OT (TDC) mark is visible and the inlet and exhaust valves in the cylinder concerned are closed.

- Tighten cylinder head nuts.

Tightening procedure after 1 000 km (600 miles)
1. Tighten the cylinder head nuts one after the other in a crosswise pattern
1.1. Slacken off one nut at a time
1.2. Tighten nut to initial torque ..... 20 Nm
1.3. Tighten nut to specified wrench angle ..... 180°
2. Unfasten/retighten M10 screw ..... 40 Nm

Checking/adjusting valve operating clearances

(Inspections I, II and III)



- Check valve clearance with feeler gauge and, if necessary, correct with adjusting nut/lock.

Adjust valve clearances with the engine cold (max. 35 °C/95 °F):
Inlet ..... 0.15 mm (0.006 in)
Exhaust ..... 0.30 mm (0.012 in)

Tightening torque:
Locknut ..... 8 Nm

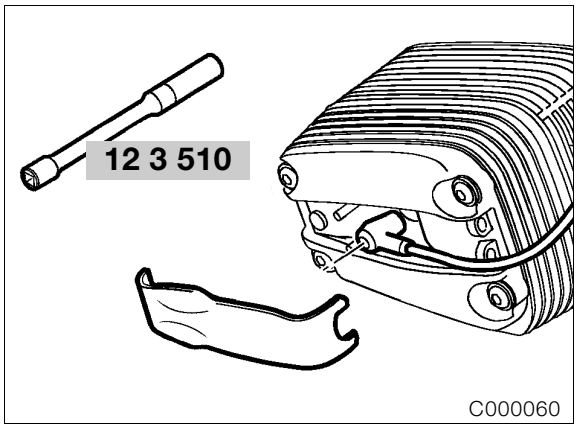
- After adjusting, check valve operating clearances again; it should be possible to pull the correct feeler gauge through between the valve stem and the adjusting screw with only slight resistance.
- Assemble in reverse order.

Caution:
Make sure that gasket is correctly seated. Gaskets and sealing faces must be free from oil or grease.

Tightening torque:
Cylinder head cover ..... 8 Nm

Checking/renewing spark plugs

(Inspection II)/renewing (Inspection III)



- Unscrew and remove spark plugs with the spark plug wrench, **BMW No. 12 3 510**.

Caution:
Do not bend electrodes - risk of breakage!

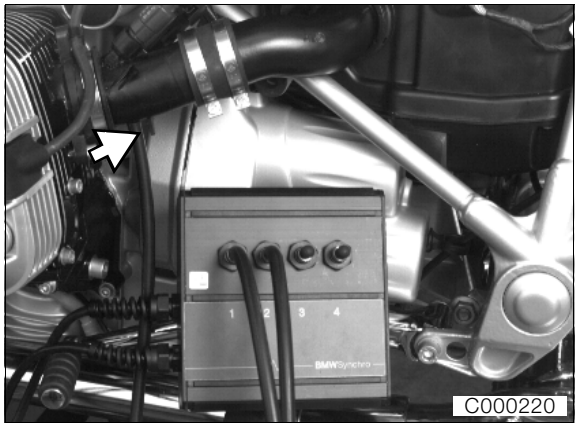
Electrode gap: ..... 0.8 mm (0.031 in)
Gap wear limit:..... 1.0 mm (0.039 in)

Tightening torque:
Spark plug..... 20 Nm

Check synchronising

(Inspections I, II and III)

- The engine must be at regular operating temperature.

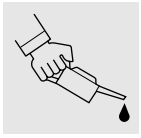


- Connect the **BMW** Synchrotester hose to the vacuum stub pipe (arrow) and the lines to the **MoDiTeC**.

Note:
If the left/right readings differ by more than 30 millibars (0.42 psi), check the air intake system for leaks.

Final inspection with road safety and functional check

(Inspections I, II, III and IV)



Road safety check

- Check wheels and tyres.
- Check/correct tyre pressures.
- Wait at least 10 minutes after the trial run/road test before checking/correcting engine oil level.

Tyre pressures:

Solo ..... front 2.2 bar (31.3 psi)
..... rear 2.5 bar (35.6 psi)
With pillion passenger ..... front 2.5 bar (35.6 psi)
..... rear 2.7 bar (38.4 psi)
With pillion
passenger + luggage..... front 2.5 bar (35.6 psi)
..... rear 2.9 bar (41.2 psi)

Roadworthiness check

- Lights
- Telltale/warning lights
- Horn
- Instruments
- Special equipment
- Clutch
- Gear shift
- Steering
- Foot brake and handbrake
- Trial run if necessary

11 Motor

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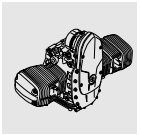

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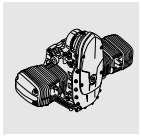

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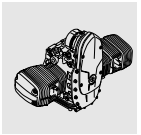
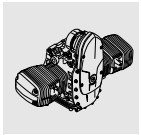
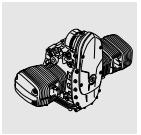
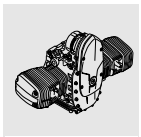




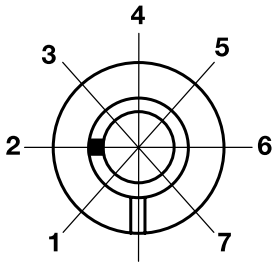
Technical data		R 850 C	R 1200 C
Engine, general			
Engine design		Four-stroke flat twin, air-cooled with oil-cooled exhaust ports, installed longitudinally, 4 valves per cylinder, two high-mounted camshafts, electronic fuel injection.	
Location of engine number		Crankcase	
Cylinder bore	mm (in)	87.5 (3.44)	101 (3.97)
Stroke	mm (in)	70.5 (2.77)	73 (2.87)
Effective displacement	cc	848	1170
Compression ratio		10.3 : 1	10.0 : 1
Power output	kW (bhp)/min^{-1}	37 (50)/5250	45 (61)/5000
Max. torque	Nm/min^{-1}	71/4750	98/3000
Permissible maximum engine speed	min^{-1}	7000	
Idle speed	min^{-1}	750^{+150}	
Direction of rotation		Clockwise, looking at ignition system	
Compression test pressure	bar (psi)		
good	bar (psi)	above 10 (142)	
normal	bar (psi)	8.5...10 (121...142)	
poor	bar (psi)	below 8.5 (121)	
Intake port dia./cylinder head	mm (in)	45 (1.77)	
Lubrication system			
Theoretical volume in circulation at 6000 min^{-1}			
Lubricating oil	l (Imp. gal/US gal)	36 (7.92/9.51)	
Cooling oil	l (Imp. gal/US gal)	30 (6.60/7.93)	
Oil filter		Full-flow type	
Pressure differential needed to open bypass valve	bar (psi)	1.5 (21.3)	
Oil pressure warning light comes on below	bar (psi)	0.2...0.5 (2.8...7.1)	
Pressure relief valve opens at	bar (psi)	5.5 (78.3)	
Operating pressure	bar (psi)	3.5...6.0 (49.8...85.4)	
Oil content			
Without filter change	l (Imp. pint/US quart)	3.50 (6.2/3.69)	
With filter change	l (Imp. pint/US quart)	3.75 (6.6/3.96)	
min/max	l (Imp. pint/US quart)	0.5 (0.88/0.53)	
Permissible oil consumption l/1000 km (miles per Imp. pint/miles per US quart)		1.0 (350/590)	
Oil pump			
Oil pump		2 Duocentric pumps	
Housing depth	mm (in)	12.02...12.05 (0.473...0.474)	
	mm (in)	10.02...10.05 (0.394...0.396)	
Height of rotor	mm (in)	11.95...11.98 (0.470...0.472)	
	mm (in)	9.95...9.98 (0.392...0.393)	
Axial play	mm (in)	0.04...0.1 (0.002...0.004)	
Wear limit	mm (in)	0.25 (0.010)	

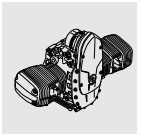


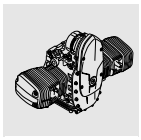


Technical data		R 850 C	R 1200 C
Valves			
Included angle between valves	°	41	
Valve clearances with engine cold (max. 35 °C/95 °F)		0.15 (0.006) 0.30 (0.012)	
Inlet valve	mm (in)		
Exhaust valve	mm (in)		
Valve timing		At zero valve clearance and 3 mm (0.12 in) valve lift	
Inlet opens		17° after TDC	
Inlet closes		15° after BDC	
Exhaust opens		15° before BDC	
Exhaust closes		17° before TDC	
		Tolerance ± 3°	
Valve head dia.			
Inlet	mm (in)	32 (1.26)	34 (1.34)
Exhaust	mm (in)	27 (1.06)	29 (1.14)
Stem dia.			
Inlet	mm (in)	4.966...4.980 (0.1955...0.1960)	
Wear limit	mm (in)	4.946 (0.1947)	
Exhaust	mm (in)	4.956...4.970 (0.1951...0.1956)	
Wear limit	mm (in)	4.936 (0.1943)	
Valve head edge thickness			
Inlet	mm (in)	1.00 $^{\pm 0.2}$ (0.04 $^{\pm 0.008}$)	
Wear limit	mm (in)	0.5 (0.02)	
Exhaust	mm (in)	1.00 $^{\pm 0.2}$ (0.04 $^{\pm 0.008}$)	
Wear limit	mm (in)	0.5 (0.02)	
Max. runout of valve head at valve seat			
Inlet, exhaust	mm (in)	0.035 (0.0014)	
Valve seat ring			
Valve seat angle			
Inlet		45°	
Exhaust		45°	
Valve seat width			
Inlet	mm (in)	1.1 $^{\pm 0.15}$ (0.043 $^{\pm 0.006}$)	
Wear limit	mm (in)	2.5 (0.10)	
Exhaust	mm (in)	1.4 $^{\pm 0.15}$ (0.055 $^{\pm 0.006}$)	
Wear limit	mm (in)	3.0 (0.12)	
Valve seat extl. dia. (dimension for machining seat)			
Inlet	mm (in)	31.4 $^{\pm 0.1}$ (1.24 $^{\pm 0.004}$)	33.4 $^{\pm 0.1}$ (1.32 $^{\pm 0.004}$)
Exhaust	mm (in)	26.4 $^{\pm 0.1}$ (1.04 $^{\pm 0.004}$)	28.4 $^{\pm 0.1}$ (1.12 $^{\pm 0.004}$)
Seat ring dia. (oversize +0.2 mm/+0.008 in)			
Inlet	mm (in)	34.634...34.650 (1.3635...1.3642)	36.617...36.633 (1.4416...1.4422)
Exhaust	mm (in)	30.134...30.150 (1.1864...1.1870)	32.134...32.150 (1.2651...1.2658)
Seat dia. in cyl. head (oversize +0.2 mm/+0.008 in)			
Inlet	mm (in)	34.500...34.525 (1.3583...1.3592)	36.500...36.525 (1.4370...1.4380)
Exhaust	mm (in)	30.000...30.025 (1.1811...1.1821)	32.000...32.025 (1.2599...1.2608)

Technical data			R 850 C	R 1200 C
Valve guide				
Valve guide	Extl. dia.	mm (in)	12.533...12.544 (0.4934...0.4939)	
Bore in cylinder head		mm (in)	12.500...12.518 (0.4921...0.4928)	
Overlap		mm (in)	0.015...0.044 (0.0006...0.0017)	
Repair stages				
Replacement valve guide	Extl. dia.	mm (in)	12.550...12.561 (0.4941...0.4945)	
Oversize valve guide	Extl. dia.	mm (in)	12.733...12.744 (0.5013...0.5017)	
Valve guide	Intl. dia.	mm (in)	5.0...5.012 (0.1969...0.1973)	
Radial clearance				
Inlet		mm (in)	0.020...0.046 (0.0008...0.0018)	
Wear limit		mm (in)	0.15 (0.006)	
Exhaust		mm (in)	0.030...0.056 (0.0012...0.0022)	
Wear limit		mm (in)	0.17 (0.007)	
Valve spring				
Spring length, off-load		mm (in)	41.1 (1.62)	
Wear limit		mm (in)	39.0 (1.54)	
Rocker				
Bore dia.		mm (in)	16.016...16.027 (0.6306...0.6310)	
Rocker shaft dia.		mm (in)	15.973...15.984 (0.6289...0.6293)	
Radial clearance		mm (in)	0.032...0.054 (0.0016...0.0021)	
Wear limit		mm (in)	0.1 (0.004)	
Axial play min.		mm (in)	0.05 (0.002)	
max.		mm (in)	0.40 (0.016)	
Camshaft				
Opening angle, inlet/exhaust cams			256°/256°	
Cam spread, inlet/exhaust			106°/109°	
Marking			Marking in position 2	
Inlet valve lift		mm (in)	8.23 (valve clearance = 0)	
Exhaust valve lift		mm (in)	8.23 (valve clearance = 0)	
Camshaft bearing bore dia.		mm (in)	21.02...21.04 (0.8276...0.8284)	
Camshaft dia.		mm (in)	20.97...21.00 (0.826...0.827)	
Radial clearance		mm (in)	0.02...0.07 (0.0008...0.0028)	
Wear limit		mm (in)	0.15 (0.006)	
Width of guide bearing		mm (in)	15.92...15.95 (0.6268...0.6280)	
Width of camshaft bearing		mm (in)	16.0...16.05 (0.630...0.632)	
Axial play		mm (in)	0.08...0.13 (0.0031...0.0051)	
Wear limit		mm (in)	0.25 (0.010)	

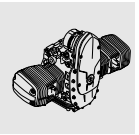


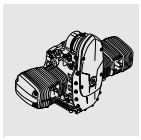




Technical data		R 850 C	R 1200 C
Bucket-type tappet			
Extl. dia.	mm (in)	23.947...23.960 (0.9428...0.9433)	
Bore dia. in cylinder head	mm (in)	24.000...24.021 (0.9449...0.9457)	
Radial clearance	mm (in)	0.040...0.074 (0.0016...0.0029)	
Wear limit	mm (in)	0.18 (0.007)	
Auxiliary shaft			
Bore dia. in crankcase front/back	mm (in)	25.020...25.041 (0.9851...0.9859)	
Auxiliary shaft dia. front/back	mm (in)	24.959...24.980 (0.9827...0.9835)	
Radial clearance	mm (in)	0.040...0.082 (0.0016...0.0032)	
Wear limit	mm (in)	0.17 (0.007)	
Crankshaft			
Marking of main bearing and crankpin on front crank web			
no paint mark		Grinding stage 0	
paint mark		Grinding stage 1 (-0.25 mm/-0.010 in)	
Grrinding stage 0 (grinding stage 1 = –0.25 mm/–0.010 in)			
Guide bearing bore dia.	mm (in)	64.949...64.969 (2.5571...2.5579)	
Guide bearing dia.	mm (in)	Green: 59.964...60.003 (2.3609...2.3624)	
		Yellow: 59.974...60.013 (2.3612...2.3628)	
Main bearing journal dia.	mm (in)	Green: 59.939...59.948 (2.3598...2.3602)	
		Yellow: 59.949...59.958 (2.3602...2.3606)	
Radial clearance	mm (in)	0.016...0.064 (0.0006...0.0025)	
Wear limit	mm (in)	0.1 (0.004)	
Main bearing bore dia.	mm (in)	60.000...60.019 (2.3622...2.3629)	
Main bearing dia.	mm (in)	Green: 54.998...55.039 (2.1653...2.1669)	
		Yellow: 55.008...55.049 (2.1657...2.1673)	
Main bearing journal dia.	mm (in)	Green: 54.971...54.980 (2.1643...2.1646)	
		Yellow: 54.981...54.990 (2.1646...2.1650)	
Radial clearance	mm (in)	0.018...0.068 (0.0007...0.0028)	
Wear limit	mm (in)	0.13 (0.0051)	
Width of guide bearing	mm (in)	24.890...24.940 (0.9799...0.9819)	
Bearing width of main bearing journal	mm (in)	25.020...25.053 (0.9851...0.9864)	
Axial play	mm (in)	0.080...0.163 (0.0031...0.0064)	
Wear limit	mm (in)	0.2 (0.008)	
Grinding stage 0 (grinding stage 1 = –0.25 mm/–0.010 in)			
Crankpin dia.	mm (in)	47.975...47.991 (1.8888...1.8894)	
Bearing width of crankpin	mm (in)	22.065...22.195 (0.8687...0.8738)	

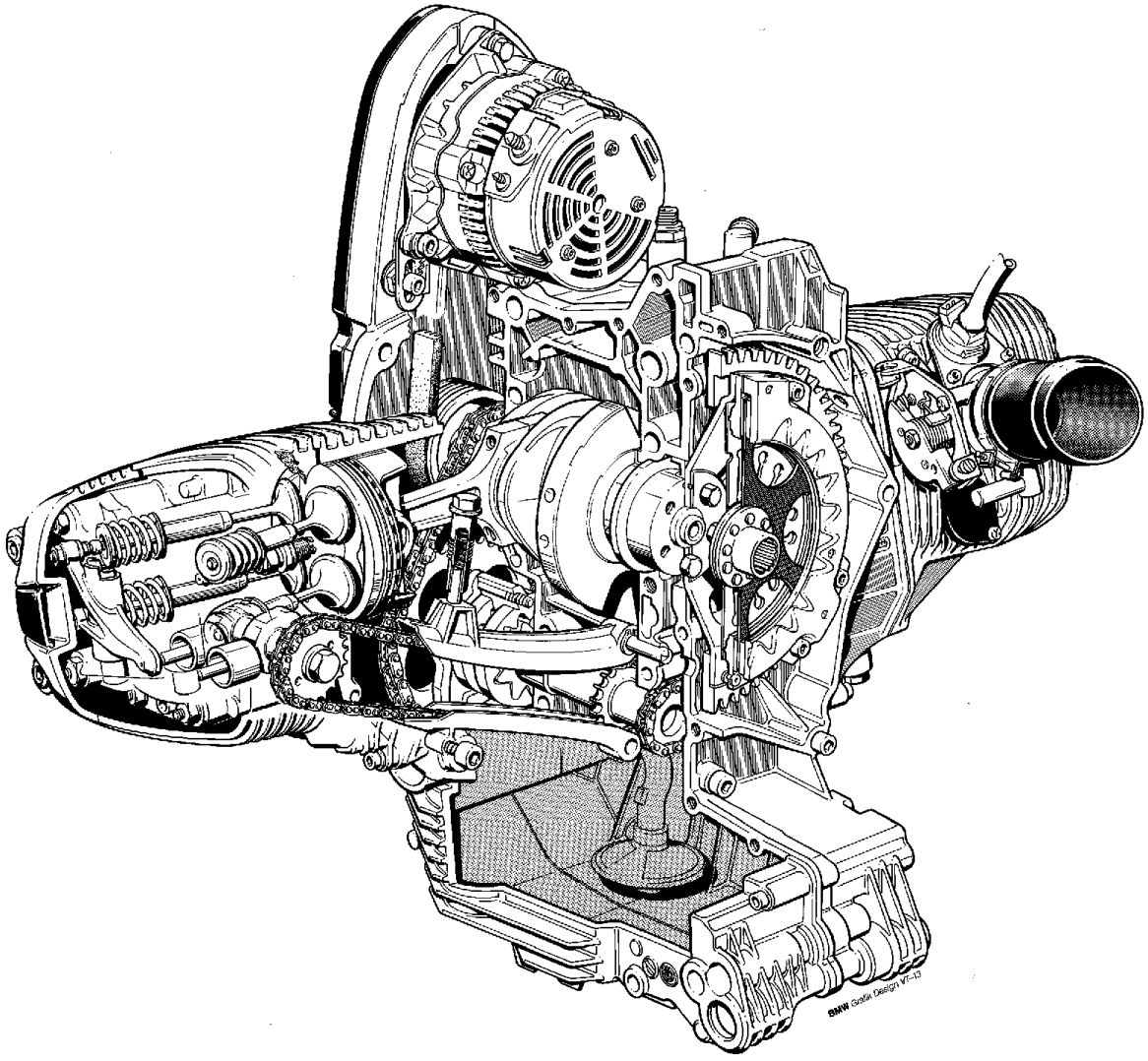
Technical data		R 850 C	R 1200 C
Connecting rod			
Bore dia. for big end bearing	mm (in)	51.000...51.013 (2.0079...2.0084)	
Big end bearing dia.	mm (in)	48.016...48.050 (1.8904...1.8918)	
Radial clearance	mm (in)	0.025...0.075 (0.0010...0.0030)	
Wear limit	mm (in)	0.13 (0.0051)	
Width of big end bearing eye	mm (in)	21.883...21.935 (0.8616...0.8636)	
Conrod end float	mm (in)	0.130...0.312 (0.0051...0.0123)	
Wear limit	mm (in)	0.5 (0.02)	
Small end bearing bore dia.	mm (in)	22.015...22.025 (0.8667...0.8671)	
Radial clearance	mm (in)	0.015...0.030 (0.0006...0.0012)	
Wear limit	mm (in)	0.06 (0.002)	
Distance between centers	mm (in)	125 (4.92)	
Max. deviation from parallel of conrod bores at 150 mm (5.90 in) spacing	mm (in)	0.07 (0.003)	
Cylinders			
Bore		(20 mm/0.79 in from top edge)	
A	mm (in)	87.492...87.500 (3.4446...3.4449)	100.992...101.000 (3.9761...3.9764)
Wear limit	mm (in)	87.550 (3.4468)	101.050 (3.9784)
B	mm (in)	87.500...87.508 (3.4449...3.4452)	101.000...101.008 (3.9764...3.9768)
Wear limit	mm (in)	87.558 (3.4471)	101.058 (3.9787)
Total wear clearance of piston and cylinder	mm (in)	0.12 (0.005)	
Permitted out-of-roundness of cylinder bore			
20 mm (0.79 in) from the top edge	mm (in)	0.03 (0.0012)	
100 mm (3.94 in) from the top edge	mm (in)	0.04 (0.0016)	
Pistons			
Piston dia.		(Measuring plane A – see Checking pistons and cylinders	
A	mm (in)	87.465...87.477 (3.4435...3.4440)	100.971...100.983 (3.9753...3.9758)
Wear limit	mm (in)	87.390 (3.4405)	100.895 (3.9723)
B	mm (in)	87.477...87.485 (3.4440...3.4443)	100.983...100.995 (3.9753...3.9763)
Wear limit	mm (in)	87.400 (3.4409)	100.905 (3.9727)
AB	mm (in)	87.473...87.481 (3.4438...3.4441)	100.979...100.987 (3.9756...3.9759)
Wear limit	mm (in)	87.395 (3.4407)	100.900 (3.9725)
Installed clearance	mm (in)	0.011...0.035 (0.0004...0.0013)	0.005...0.029 (0.0002...0.0011)
Total wear clearance of piston and cylinder	mm (in)	0.12 (0.005)	
Piston pin bore dia.	mm (in)	22.005...22.011 (0.8664...0.8666)	
Weight classes		+ and –	
Weight difference in one class	grammes (oz)	10 (0.353) (complete with pins and rings)	
Direction of installation		Arrow on piston crown pointing to exhaust side Production locating point towards exhaust side (see Installing piston)	



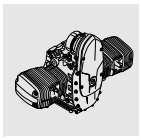


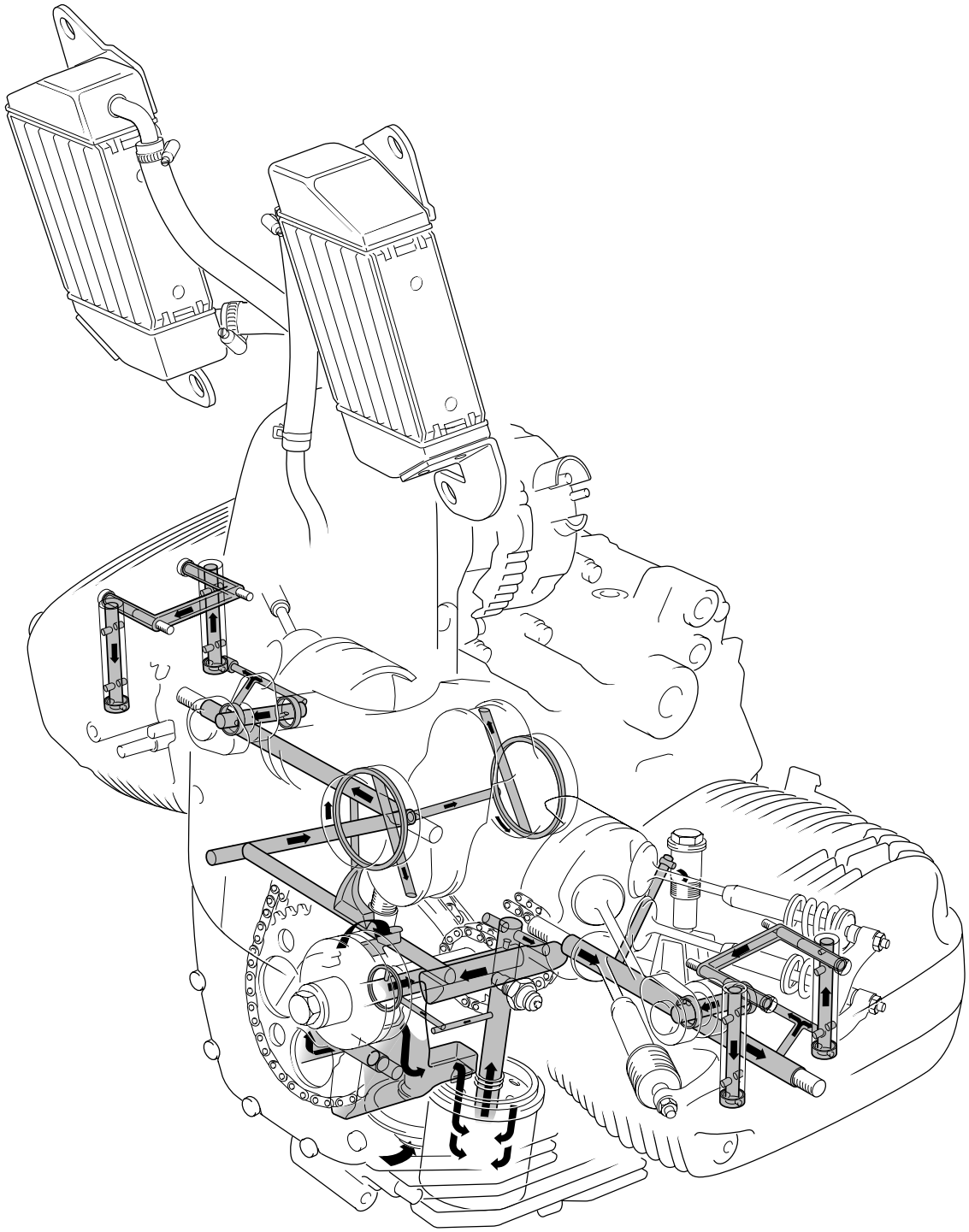
Technical data			R 850 C	R 1200 C
Piston rings				
1st groove	Piston ring asymmetrical, convex oval			
	Height	mm (in)	1.170...1.190 (0.0461...0.0469)	
	Wear limit	mm (in)	1.1 (0.043)	
Gap clearance		mm (in)	0.1...0.3 (0.004...0.012)	
	Wear limit	mm (in)	0.8 (0.031)	
Side clearance		mm (in)	0.030...0.070 (0.0012...0.0027)	
	Wear limit	mm (in)	0.15 (0.0006)	
2nd groove	Micro-taper compression ring			
	Height	mm (in)	1.170...1.190 (0.0461...0.0469)	
	Wear limit	mm (in)	1.1 (0.043)	
Gap clearance		mm (in)	0.2...0.4 (0.008...0.016)	
	Wear limit	mm (in)	1.0 (0.040)	
Side clearance		mm (in)	0.030...0.070 (0.0012...0.0027)	
	Wear limit	mm (in)	0.15 (0.0006)	
3rd groove	Equal-chamfer ring + tubular spring			
	Height	mm (in)	1.970...1.990 (0.0776...0.0783)	
	Wear limit	mm (in)	1.9 (0.075)	
Gap clearance		mm (in)	0.30...0.55 (0.012...0.022)	
	Wear limit	mm (in)	1.20 (0.047)	
Side clearance		mm (in)	0.020...0.060 (0.0008...0.0024)	
	Wear limit	mm (in)	0.15 (0.0006)	
Installed direction of piston rings			“Top” marking uppermost	
Piston pin				
Piston pin dia.		mm (in)	21.995...22.000 (0.8660...0.8662)	
	Wear limit	mm (in)	21.960 (0.8646)	
Bore dia. in piston		mm (in)	22.005...22.011 (0.8664...0.8666)	
Radial clearance in piston		mm (in)	0.005...0.016 (0.0002...0.0006)	
	Wear limit	mm (in)	0.070 (0.0027)	

Sectioned drawing of engine

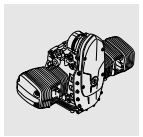


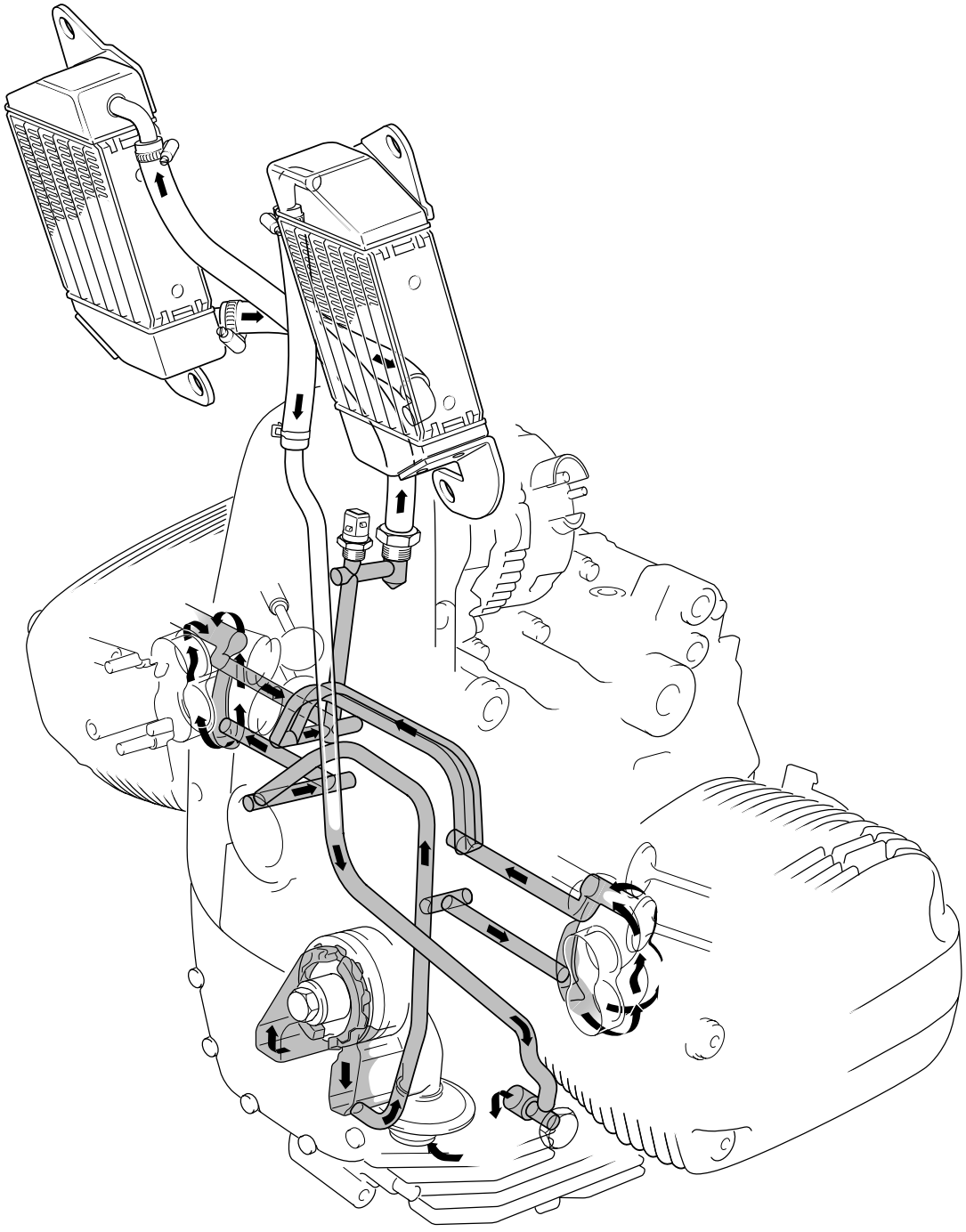
Lubricating oil circuit

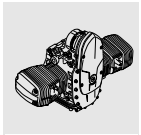




Coolant circuit



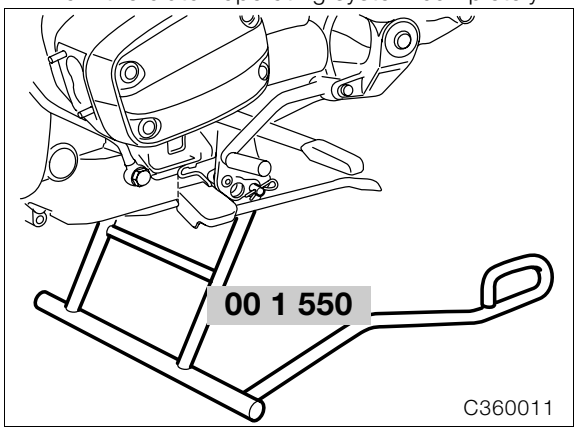




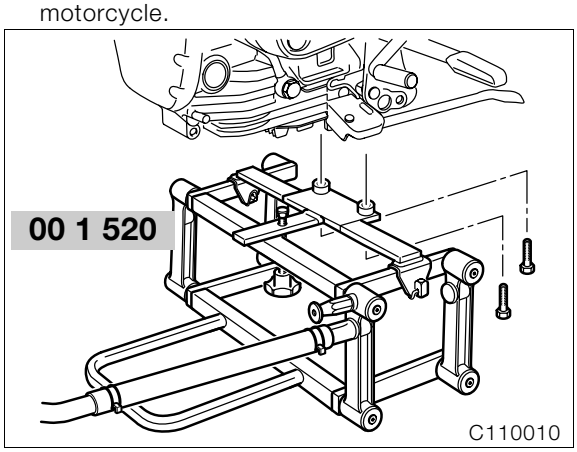
Removing engine

Note:
Auxiliary shaft, timing chains, chain tensioner/guide rails and crankshaft can only be dismantled after the engine has been removed. All other components can be dismantled while the engine is still installed.

- Drain engine oil.
- Drain the brake system completely.
- Drain the clutch operating system completely.



- Attach auxiliary stand, **BMW No. 00 1 550**, to the motorcycle.



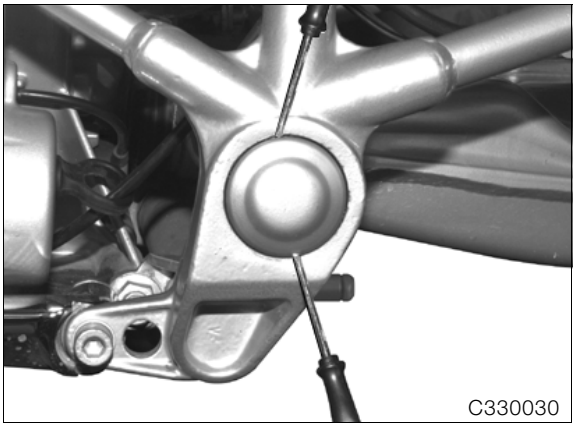
- Attach stand, **BMW No. 00 1 520**, to motorcycle.
- Remove seat.
- Remove side trim.
- Remove fuel tank.
- Remove the battery.

Caution:
Disconnect negative terminal first, then positive terminal.

- Remove rear wheel.
- Detach the rear brake caliper.
- Detach the ABS sensor.
- Detach the speedometer sensor.
- Remove exhaust manifold.
- Remove silencer (muffler).
- Separate oxygen sensor plug.
- Remove line protection from swinging arm.
- Tie the swinging arm up to the rear frame with a strap.
- Remove suspension strut.

Note:
Press the upper suspension strut to the rear.

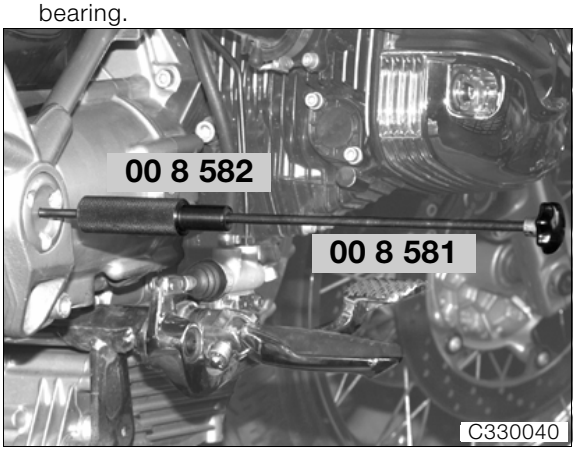
- Remove rear wheel drive unit.
- Detach brake hose holder at rear frame.



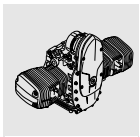
- Press off the left swinging arm bearing cap.

Caution:
When installing, make sure the O-ring is in good condition.
Install with the drain hole pointing down.

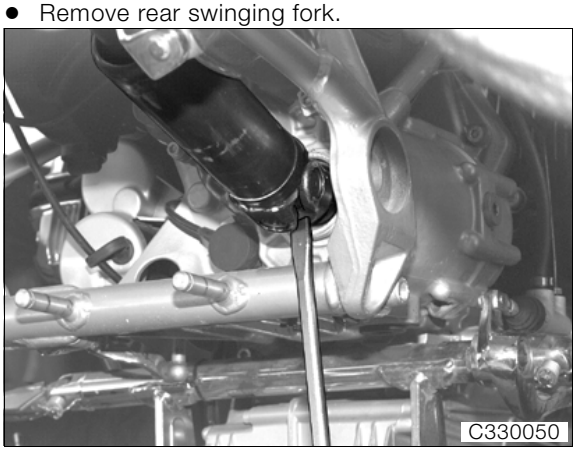
- Loosen the left swinging arm bearing.
- Loosen the screws at the right swinging arm bearing.



- Use pull rod, **BMW No. 00 8 581**, and impact weight, **BMW No. 00 8 582**, to pull out the swinging arm bearing.
- Remove the left swinging arm bearing.

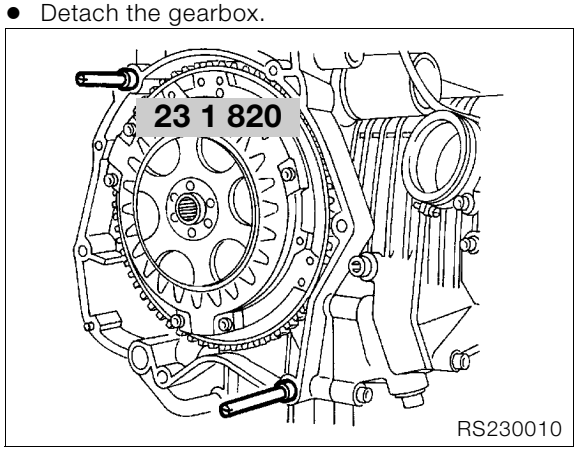


- Remove rear swinging fork.



- Press off drive shaft.
- Remove the air intake stub pipe.
- Remove brake fluid reservoir from holder.
- Remove the holder.
- Take off the right plug retaining plate.
- Pull the air temperature plug off the air cleaner cover.
- Detach the gear lever at the pivot.
- Remove the gear lever.
- Separate the plug for the throttle angle potentiometer and the throttle positioner at the left plug retaining plate.
- Disconnect both fuse boxes at the plug retaining plate.
- Separate the side (prop) stand safety switch plug.
- Separate the neutral indicator plug.
- Detach the left plug retaining plate.
- Remove the injector nozzles.
- Pull the plug off the injector line.
- Separate the plug for the rear brake light switch and detach the wire.
- Detach the vent hose at the air cleaner housing.
- Disconnect the throttle cable at the twistgrip.
- Remove rear section of frame.
- Remove the auxiliary stand.
- Remove the footrest holder.
- Remove the starter motor cover.
- Detach cable from starter motor.
- Remove the starter motor.
- Separate the clutch line where it passes through the frame.
- Remove the clutch slave cylinder with line.
- Pull out the thrust rod.

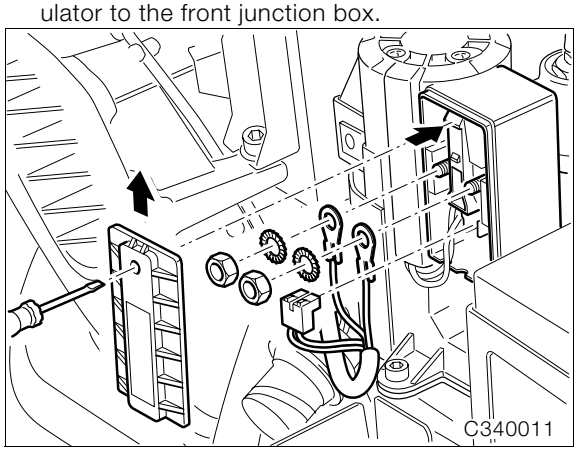
- Detach the gearbox.



- When removing the gearbox, pull it out on guide pins, **BMW No. 23 1 820**.
- Remove the Motronic control unit.
- Disconnect the wires in the central electrical equipment box.

– Instruments
– Right combined switch
– Left combined switch
– Front brake light switch
– Clutch switch
– Front ABS sensor

- Undo the cable straps at the wiring.
- Detach the central electrical equipment box.
- Remove the brake lines from the pressure modulator to the front junction box.



- Detach the lines at the pressure modulator.
- Remove the ABS unit.

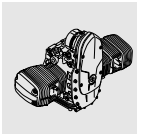
Caution:
Comply exactly with the instructions in the Repair Manual.
➟Group 34

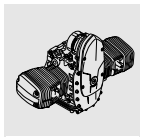
- Remove battery carrier.
- Remove the horn.
- Remove the ignition coil.
- Pull off the plug cap with special puller, **BMW No. 12 3 520**, and remove the ignition lead.
- Open the headlight housing.
- Detach the headlight cable.
- Detach the flashing turn indicator wires.
- Detach the oil pressure switch wire.
- Detach the alternator cables.

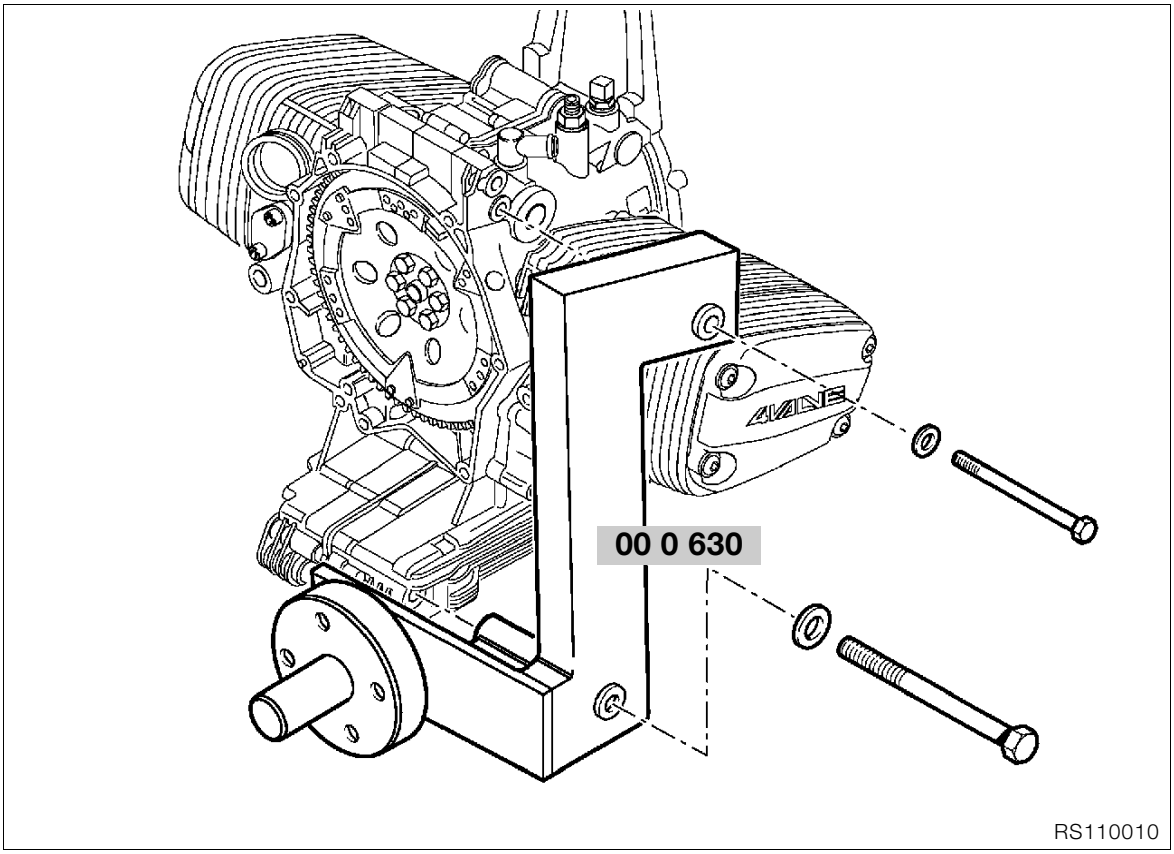
- Detach the central earth (ground) wire at the engine block.
- Remove the left air intake pipe at the cylinder head.
- Heat the ball joint mount at the leading link to max. 120 °C (248 °F) and detach it.

⚠ Caution:
Do not scratch the surface of the leading link.

- Detach the line for the front brake caliper at the junction block/frame.
- Remove the caps from the threaded connections on the fixed tubes.
- Separate the fixed tube from the fork bridge at the threaded connections.
- Remove the telescopic fork.
- Remove the cover plate over the upper suspension strut mount on the frame.
- Remove suspension strut.
- Remove the leading link caps.
- Remove the left screw cap.
- Remove the circlip at the right and the safety cap.
- Take out the screw at the right and pull the shaft out to the left.
- Remove the leading link.
- Detach the hose for the oil cooler at the engine.
- Remove frame.
- Install by following the above work instructions in the reverse order.

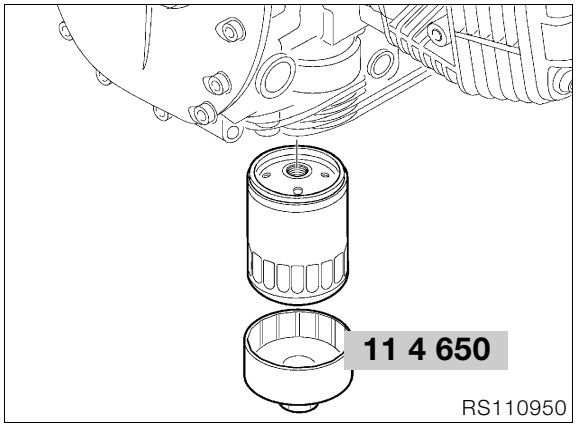




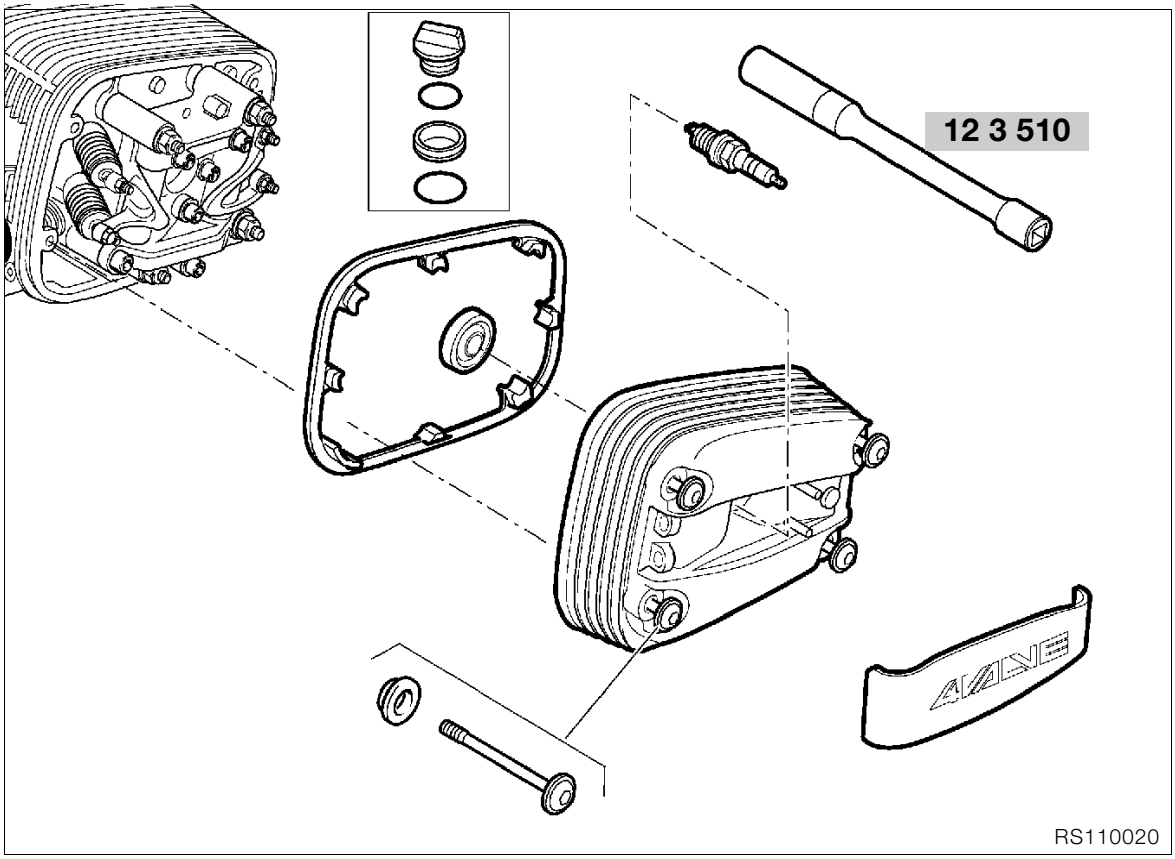


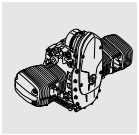
Dismantling engine

- Attach engine mount, **BMW No. 11 0 630**, to the engine block.
- Transfer engine to assembly frame.



- Drain engine oil.
- Remove the oil filter, using oil filter wrench, **BMW No. 11 4 650**.

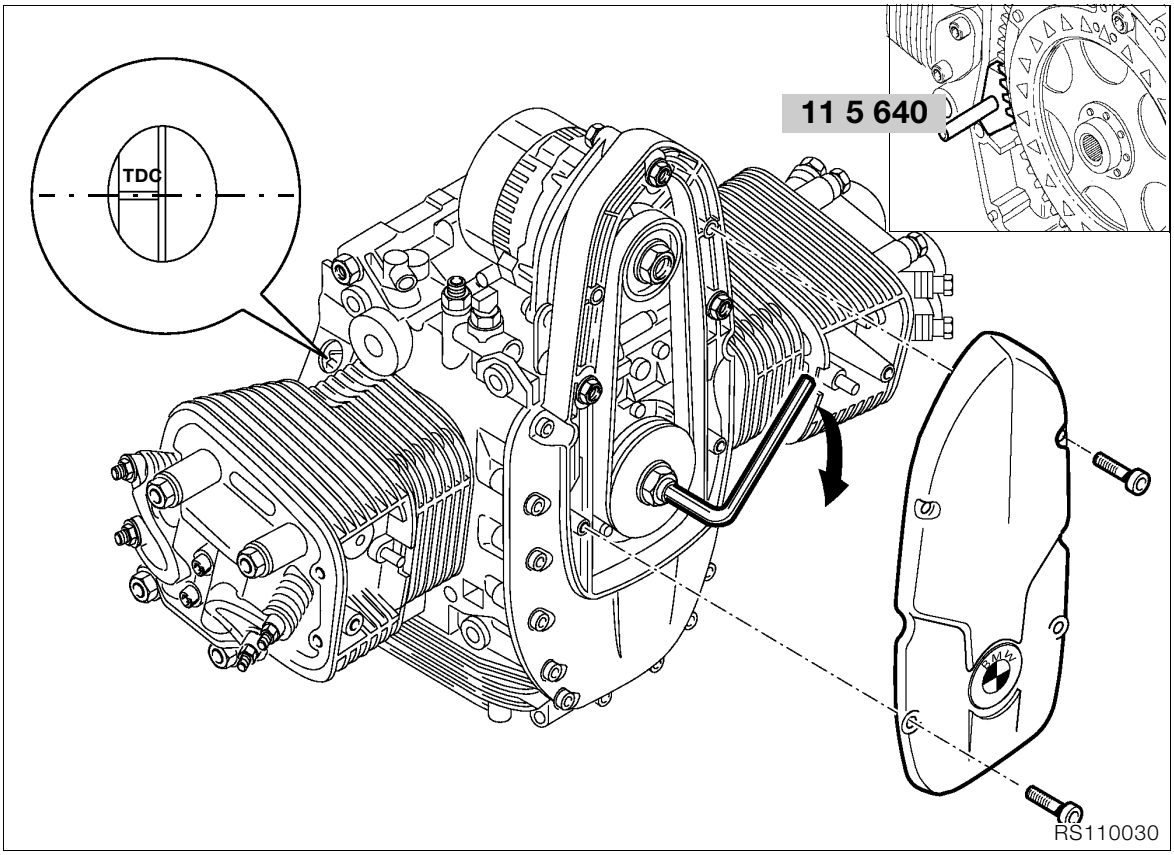




Removing cylinder head cover

- Unscrew and remove spark plug with the spark plug wrench, **BMW No. 12 3 510**.
- Remove cylinder head cover.

⚠ Caution:
Trap escaping oil.



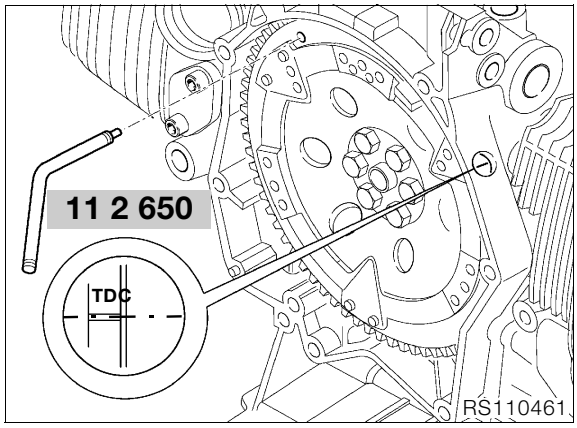
Locking the engine in the TDC position

- Remove front cover.
- Turn the belt pulley to move the piston to TDC on the ignition stroke.

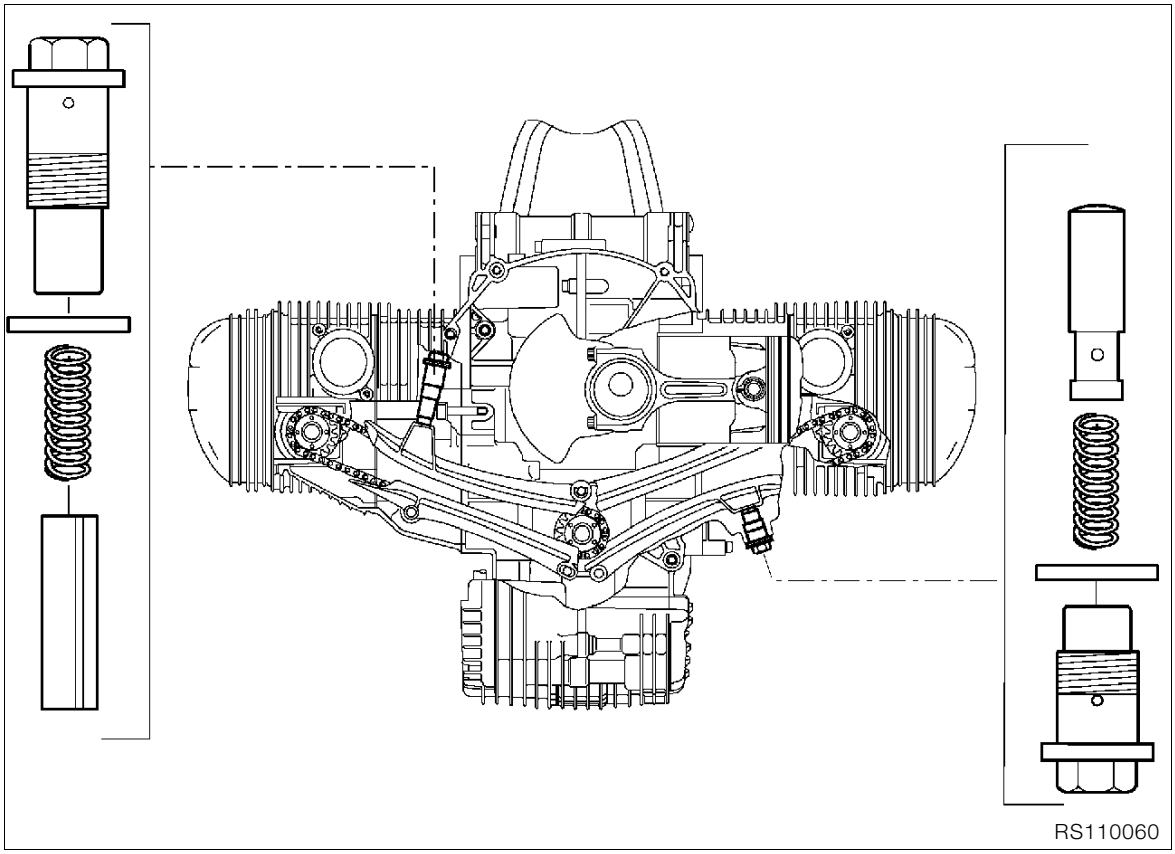
Top dead centre on ignition stroke:

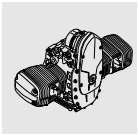
1. TDC mark is visible, and
2. The inlet and exhaust valves in the cylinder in question are closed.

- Prevent the clutch housing from moving with locking device, **BMW No. 11 5 640**.



Note:
The engine can be correctly positioned at TDC with locating pin, **BMW No. 11 2 650**, through the hole in the clutch housing and the engine block.





Removing and installing chain tensioner

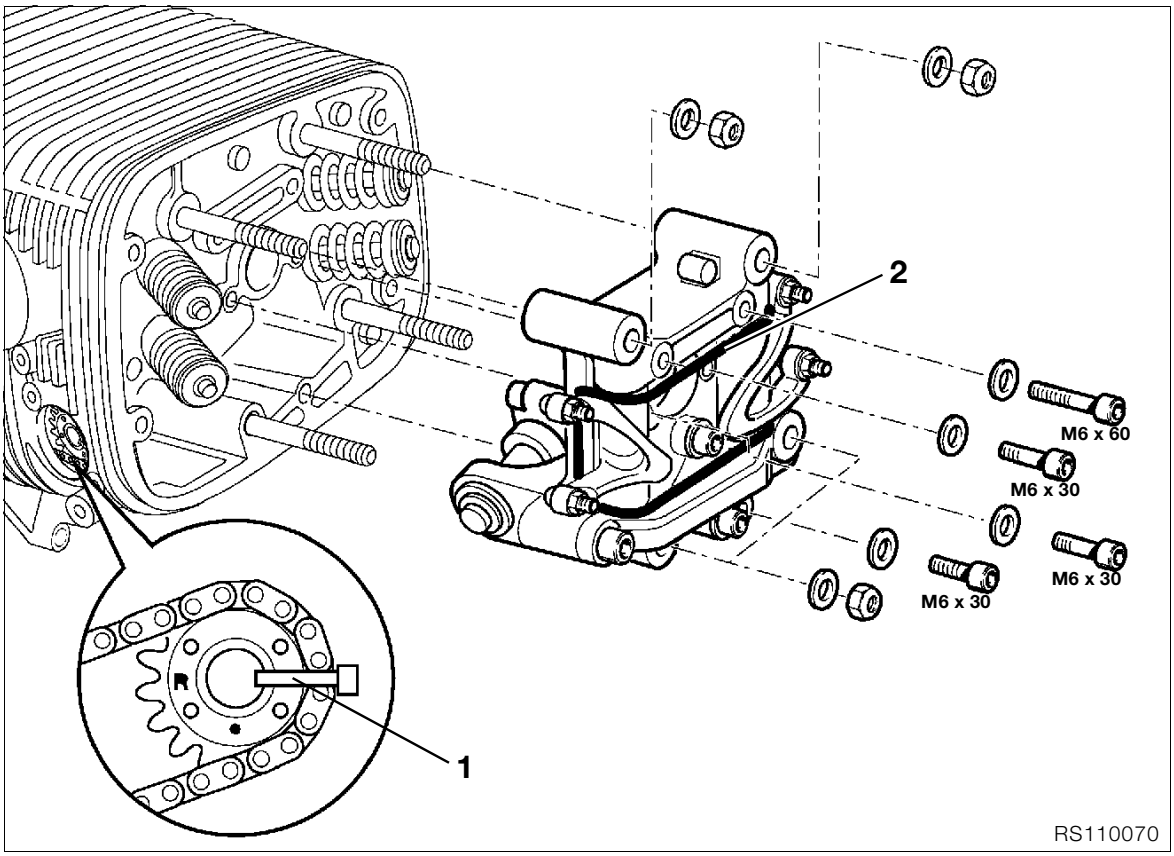
Caution:
Do not accidentally confuse the chain tensioner pistons. When installing, fit a new gasket.

Assembly specification for timing chain tensioner:
Removal:
- Remove timing chain tensioner, then remove camshaft sprocket from camshaft.

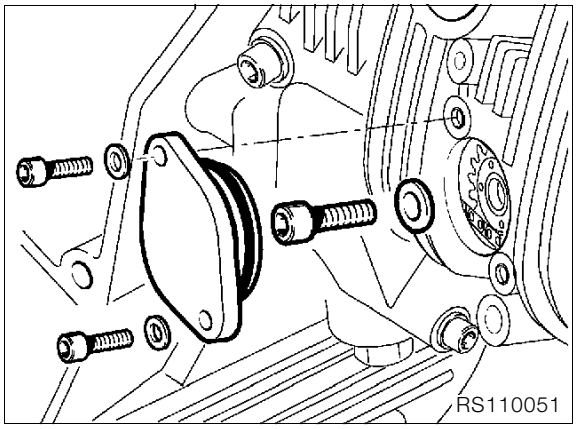
Installing:
- First install camshaft sprocket, then timing chain tensioner.

Caution:
Failure to observe this sequence can cause the chain tensioner piston to fall into the left side of the timing chain cavity.

Tightening torque:
Chain tensioner ..... 32 Nm



Removing valve gear holder

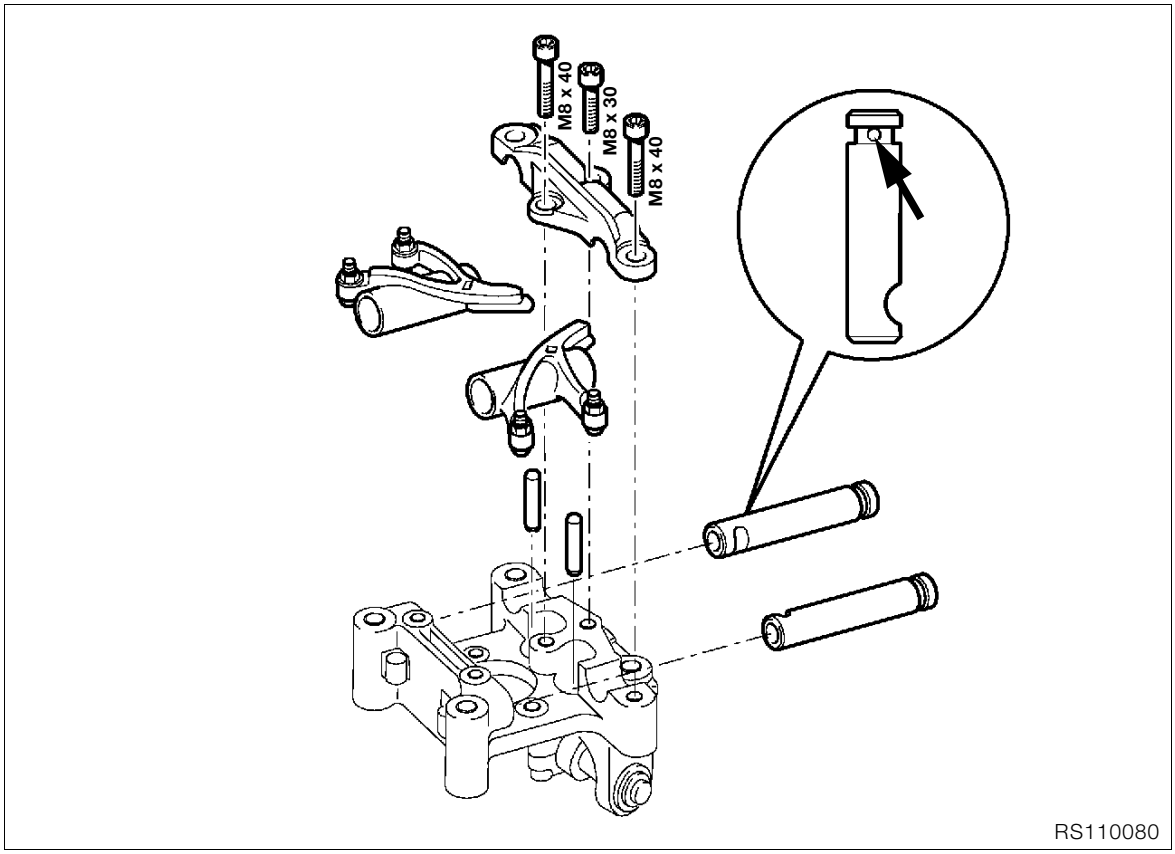


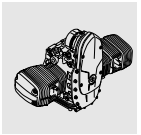
- Remove camshaft sprocket cover.
- Unscrew/press off camshaft sprocket.

Note:
If the camshaft sprocket (1) is not removed after loosening, it must be held firmly and prevented from falling into the engine block (e.g. with a cable strap).

- Remove valve gear holder.
- Secure rockers with a rubber band (2).

Note:
If no work is carried out on the valve gear holder, remove it together with the cylinder head.

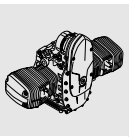


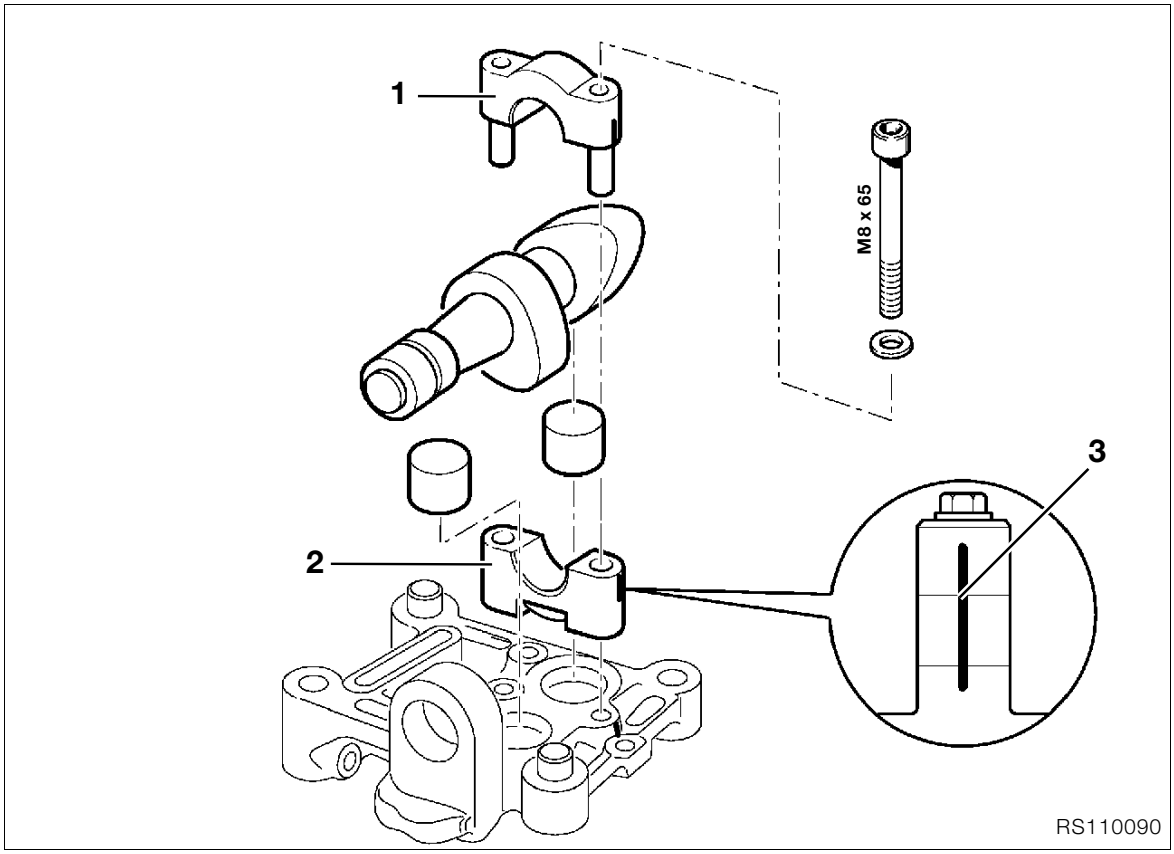


Dismantling/reassembling valve gear holder

- Remove bearing cap.
- Insert a suitable drift into the bore (arrow) of the rocker shaft, and pull the shaft out of the mount by twisting it in both directions.
- Remove pushrods.

⚠ Caution:
Do not accidentally confuse rocker shafts and push-rods.





- Remove camshaft bearing cap (1).
- Remove camshaft and bearings (2).
- Remove bucket-type tappets.

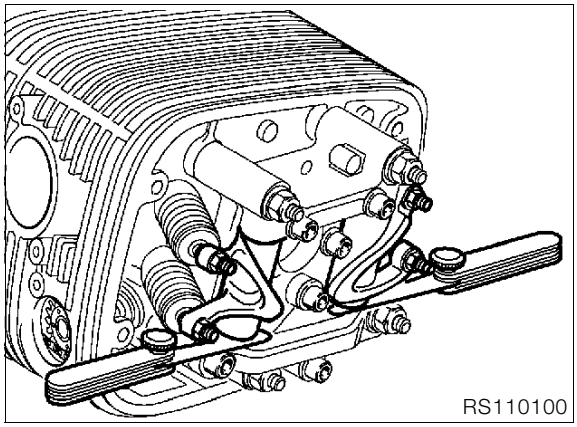
Caution:
Do not accidentally confuse the bucket-type tappets.

- Reassemble in the reverse order of work.

Caution:
Note direction of installation (3) for camshaft bearing cap. The cutout on the rocker shafts must be aligned with the retaining holes.

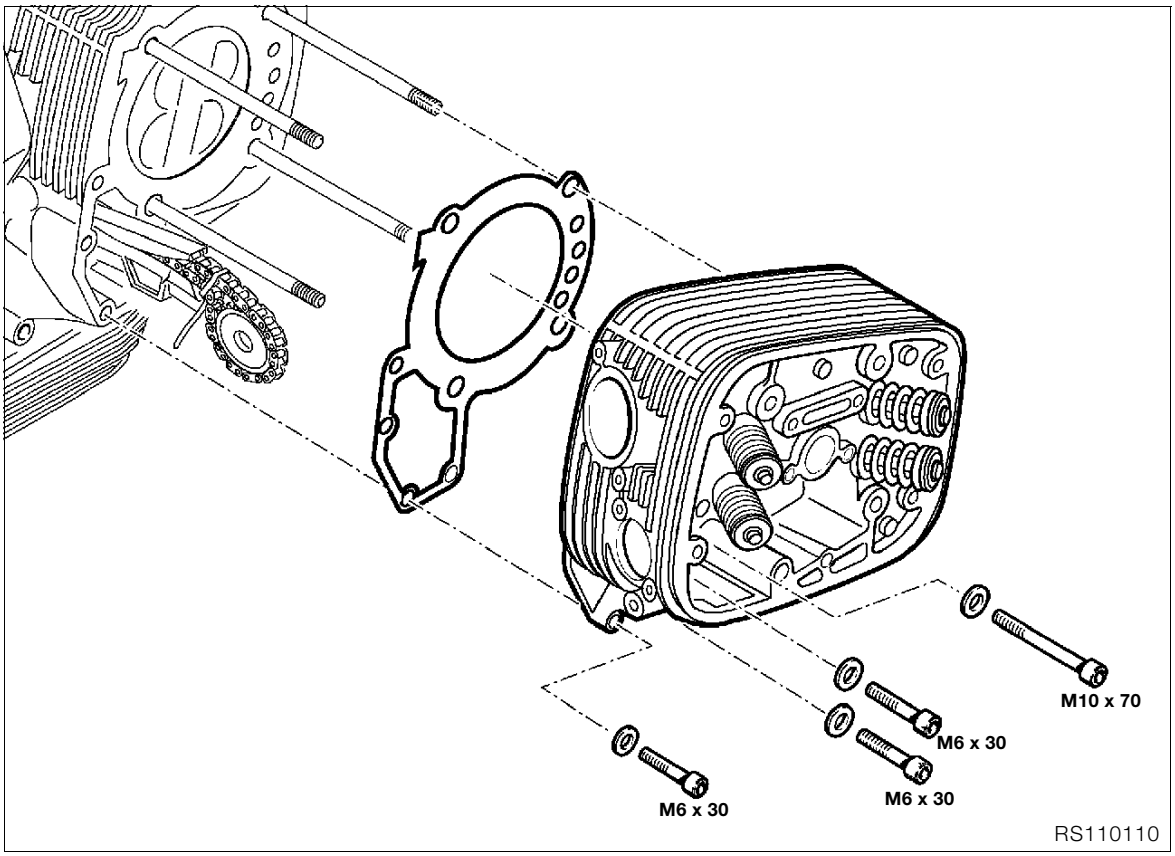
Note:
Locate pushrods in ball cups on rockers and hold the rockers together with a rubber band to secure the pushrods in position.

Tightening torque:
M 8 screw, rocker shaft bearing cap ..... 15 Nm
M 8 screw for camshaft bearing cap ..... 15 Nm

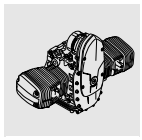


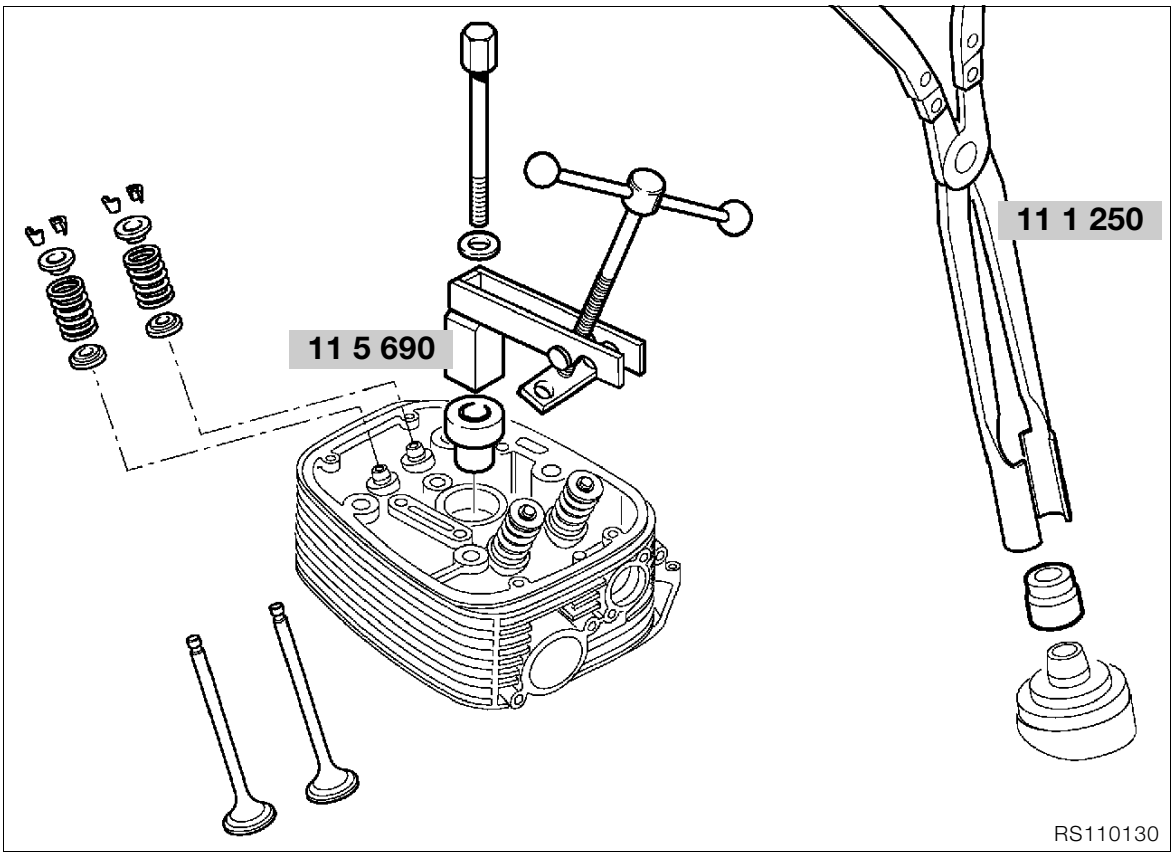
- Reposition the bearings until minimum endplay is obtained.

End float of rocker:
min. ..... 0.05 mm (0.002 in)
max. ..... 0.40 mm (0.016 in)



Removing cylinder head





Dismantling, checking, repairing and re-assembling cylinder head

Removing and installing valves

Caution:
Do not scratch sealing face on cylinder head. Place the head on a clean, scratch-free surface.

- Attach valve spring tensioner, **BMW No. 11 5 690**, to cylinder head.
- Clamp the valve springs.
- Separate valve collet from spring plate by striking the valve head gently.
- Remove valve collet sections.
- Relieve tension on valve springs.
- Remove top/bottom spring plates, valve springs and valves.

Removing valve stem seals

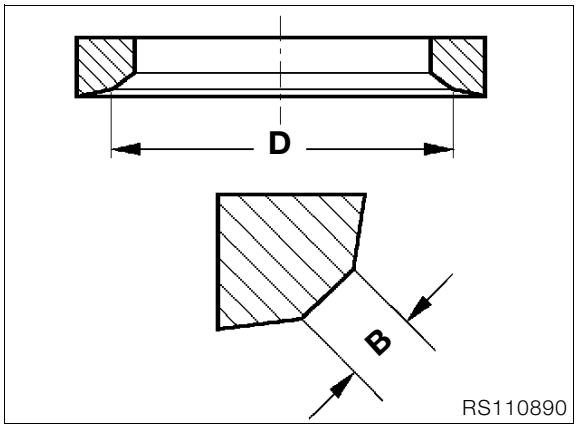
- Pull off valve stem seal with pliers, **BMW No. 11 1 250**.

Note:
If a valve is removed, the valve stem seal must be renewed.

Checking valves for wear
- Clean combustion residue from valves.
- Check valve dimensions.

➠ .....See Technical data

Remachining valve seat



Caution:
Width (B) and diameter (D) must always be maintained when remachining the valve seat.

➠ .....See Technical data

Checking and repairing cylinder head
- Remove combustion residues from combusion chamber.
- Check sealing face for damage/distortion, and skim flat if necessary.

Skimming sealing face: ..... max. 0.2 mm (0.008 in) metal removal

Checking valve guide for wear
- Check valve guide bore.

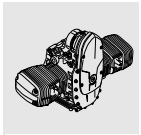
➠ .....See Technical data

Replacing valve guides

- Heat cylinder head slowly and uniformly to 200 °C (392 °F) in a suitable oven.

Caution:
Wear protective gloves when handling heated parts.

- Drive out valve guides with 5 mm (0.20 in) dia. extractor pin, **BMW No. 11 5 674**, from the combustion chamber side.
- Allow cylinder head to cool down to room temperature (app. 20 °C/68 °F).
- Examine valve guide bore for:



– wear,
– widening taper and
– correct dimensions in H7 tolerance range (12.500...12.518 mm/0.4921...0.4928 in).

Note:
Valve guides are installed in the cylinder head with an interference fit of 0.015...0.044 mm (0.0006...0.0017 in).

If valve guide bore is undamaged and dimensions are within correct 12.5 H7 tolerance range:

- Use original 12.5 U6 (12.533...12.544 mm/ 0.4934...0.4939 in) valve guide.
- Measure valve guides with micrometer.

If valve guide bore is undamaged but slightly larger than the 12.5 H7 tolerance range:

- Use replacement valve guide 12.550...12.561 mm (0.4941...0.4945 in).

If valve guide bore is damaged or not to correct dimensions in 12.5 H7 tolerance range:

- Use an oversize 12.7U6 (12.733...12.744 mm/ 0.5013...0.5017 in) valve guide.

Repair method 1 – ream out the bore (if bore is damaged or not to correct dimensions)

- Determine actual diameter of valve guide using micrometer.
- Open out bore with Ø12.7 H7 mm (12.700...12.718 mm/0.5000...0.5007 in) reamer.

Repair method 2 – lathe-turn the valve guide (bore must not be damaged)

- Determine actual diameter of bore with internal measuring tool.
- Calculate the nominal diameter of the valve guide:

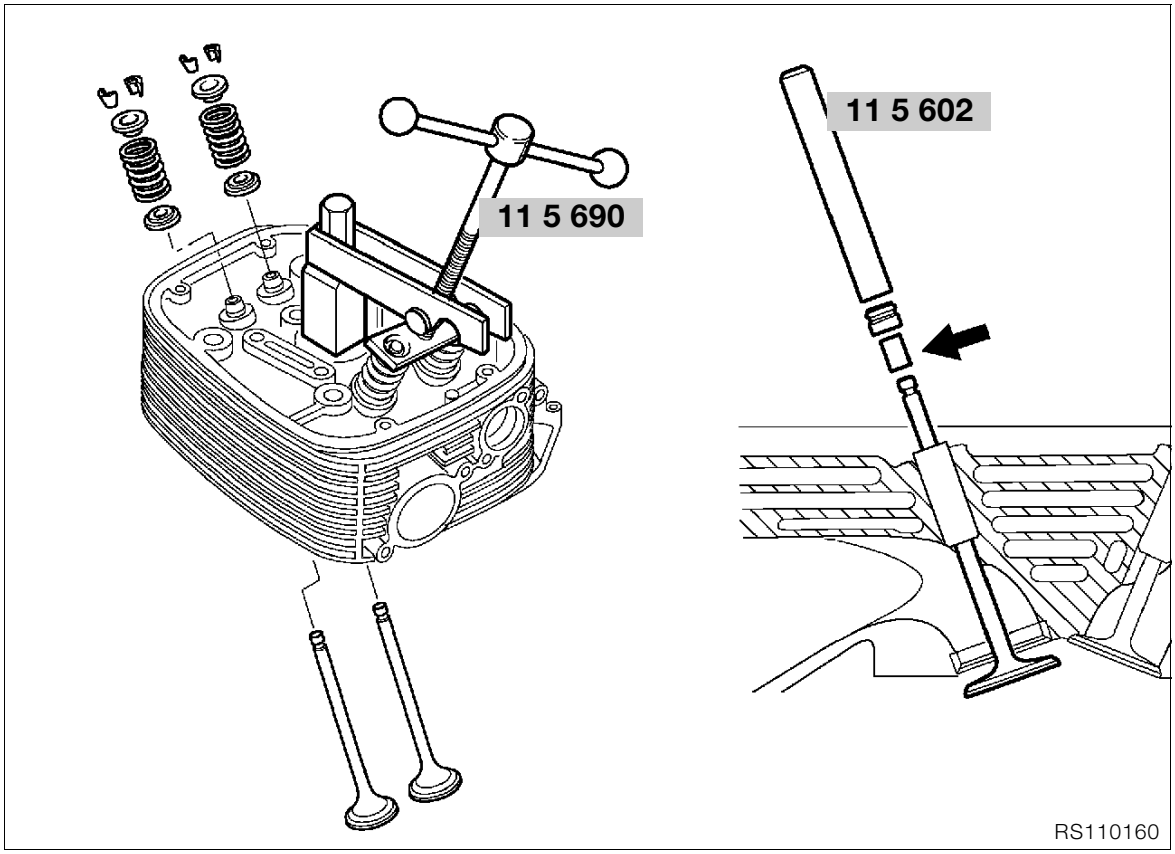
Nominal diameter of valve guide = bore dia. + interference-fit value (0.015...0.044 mm/ 0.0006...0.0017 in).

- Use an oversize 12.7 U6 (12.733...12.744 mm/ 0.5013...0.5017 in) valve guide.
- Turn down oversize valve guide to nominal dimension.
- Slowly heat cylinder head to 200 °C (392 °F) in a suitable oven.
- Immerse valve guide in liquid grinding paste.
- Freeze valve guide with dry ice.

Caution:
Immediately before pressing in, the temperature must be –40 °C (–40 °F).

- Place heated cylinder head flat on workbench or a similar surface.
- After cooling, place the valve guide on driving-in pin, driving-in pin, Ø 5mm (0.20 in), **BMW No. 11 5 673**.
- Insert valve guides into cylinder head with no delay.
- Allow cylinder head to cool down to room temperature, app. 20 °C (68 °F).
- Inspect bore in valve guide.

Note:
Valve guides for repair purposes are produced with an internal diameter of 5.01 mm (0.1972 in) H7. In most cases, the bore is within the 5.00 mm (0.1969 in) H7 tolerance range after pressing in. If the bore is too narrow, ream it out to size.



Installing valve and valve stem seal

Note:
If a valve was removed, the valve stem seal must be renewed.

- Oil the stem when installing the valve.
- Shrink a short length of tube (arrow) on to the end of the valve stem.
- Install the valve stem seal with a 5 mm (0.20 in) dia. drift, **BMW No. 11 5 602**.

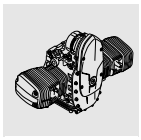
Caution:
Remove the shrunk-on tube.

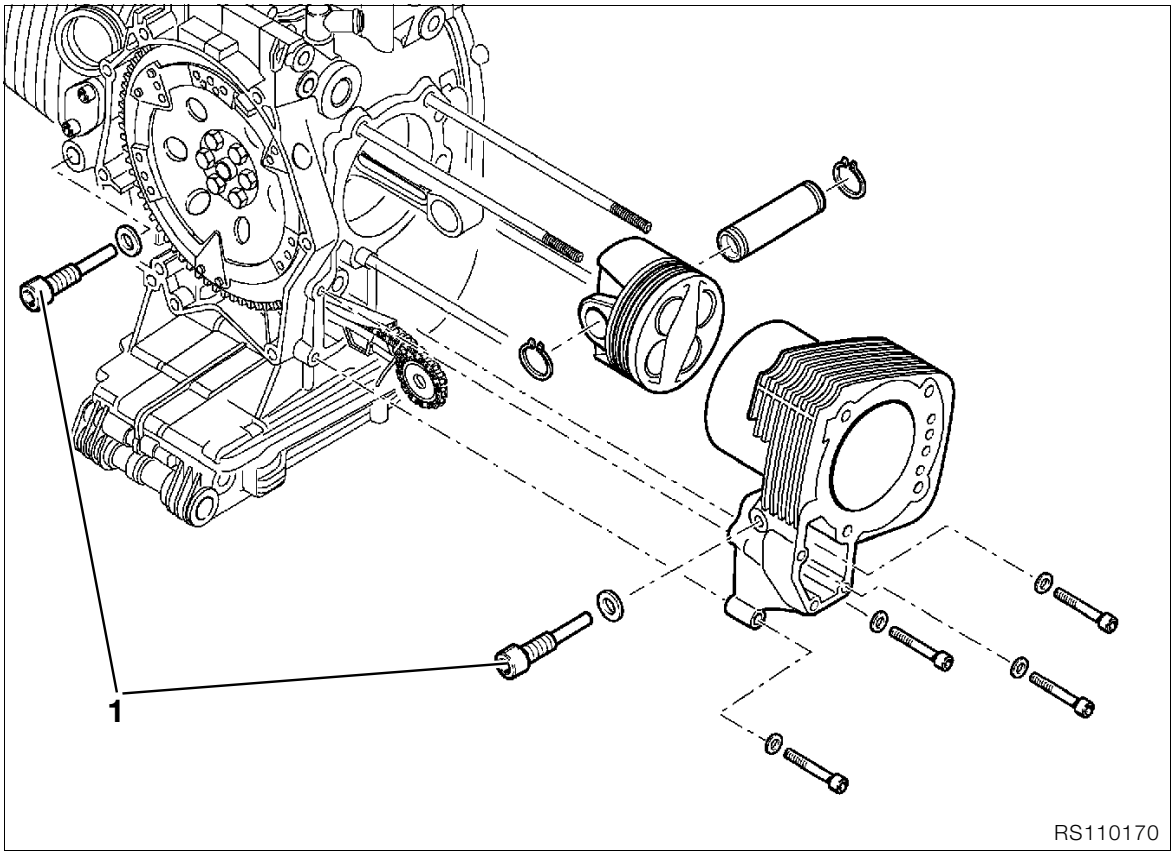
- Fit lower spring plate, valve spring and upper spring plate.
- Compress the valve springs with the valve spring clamp, **BMW No. 11 5 690**.

Note:
Insert the taper valve collets using grease (to simplify assembly).

Caution:
Ensure that valve collets are correctly seated in the valve stem grooves.

- Relieve tension on valve springs.
- Check valves for leakage (blow-by).





Removing cylinder barrel

- Unscrew and remove guide rail bearing screw (1).
- Unscrew and remove cylinder retaining screws, and remove cylinder.

⚠ Caution:
When removing cylinder, ensure that the piston does not strike the engine block.

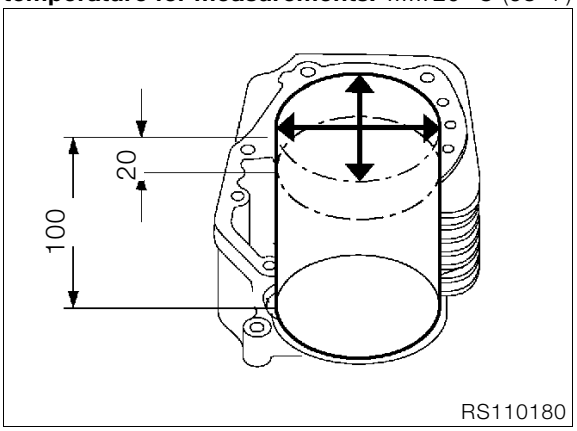
Removing/dismantling piston

- Remove both retaining rings on piston pin.
- Press out piston pin by hand.
- Remove piston.
- Carefully remove piston rings with piston ring pliers.
- Remove carbonized oil from base of piston/clean the piston.

⚠ Caution:
Do not accidentally confuse pistons, piston pins or piston rings.

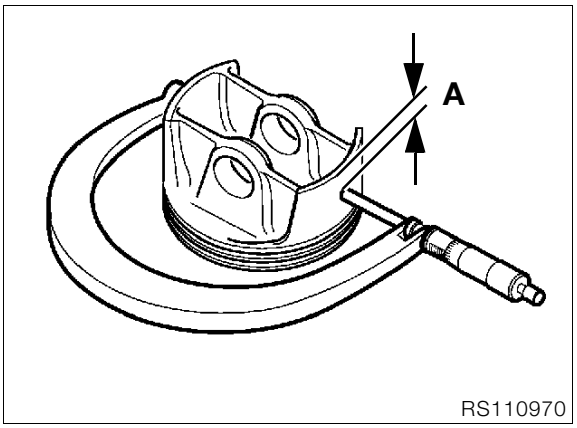
Checking pistons and cylinders

Reference temperature for measurements: ..... 20 °C (68 °F)



- Measure cylinder bore with internal probe at 20 mm (0.79 in) and 100 mm (3.94 in) from the top in direction of piston pin, and again at a right angle to the first measurement.

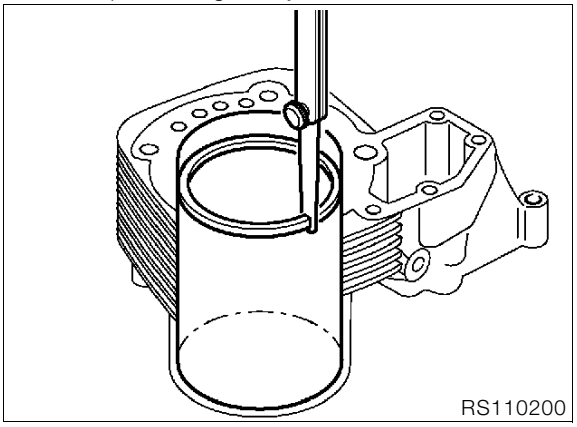
➟ .....See Technical data



Measuring plane A:..... 6 mm (0.24 in)

➟ .....See Technical data

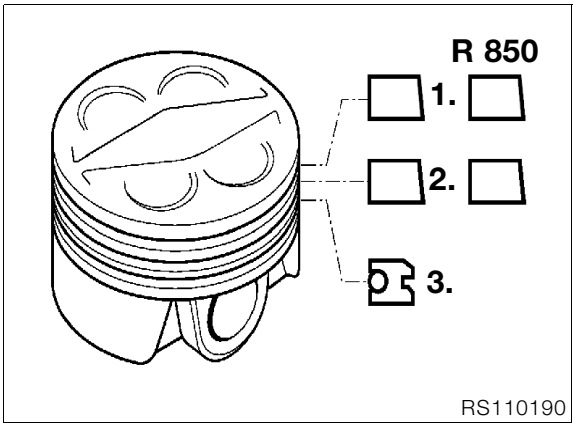
- Install piston rings in cylinder.



- Determine piston ring clearance using feeler gauge.

➟ .....See Technical data

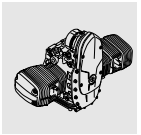
Assembling pistons

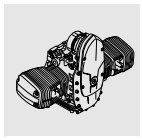


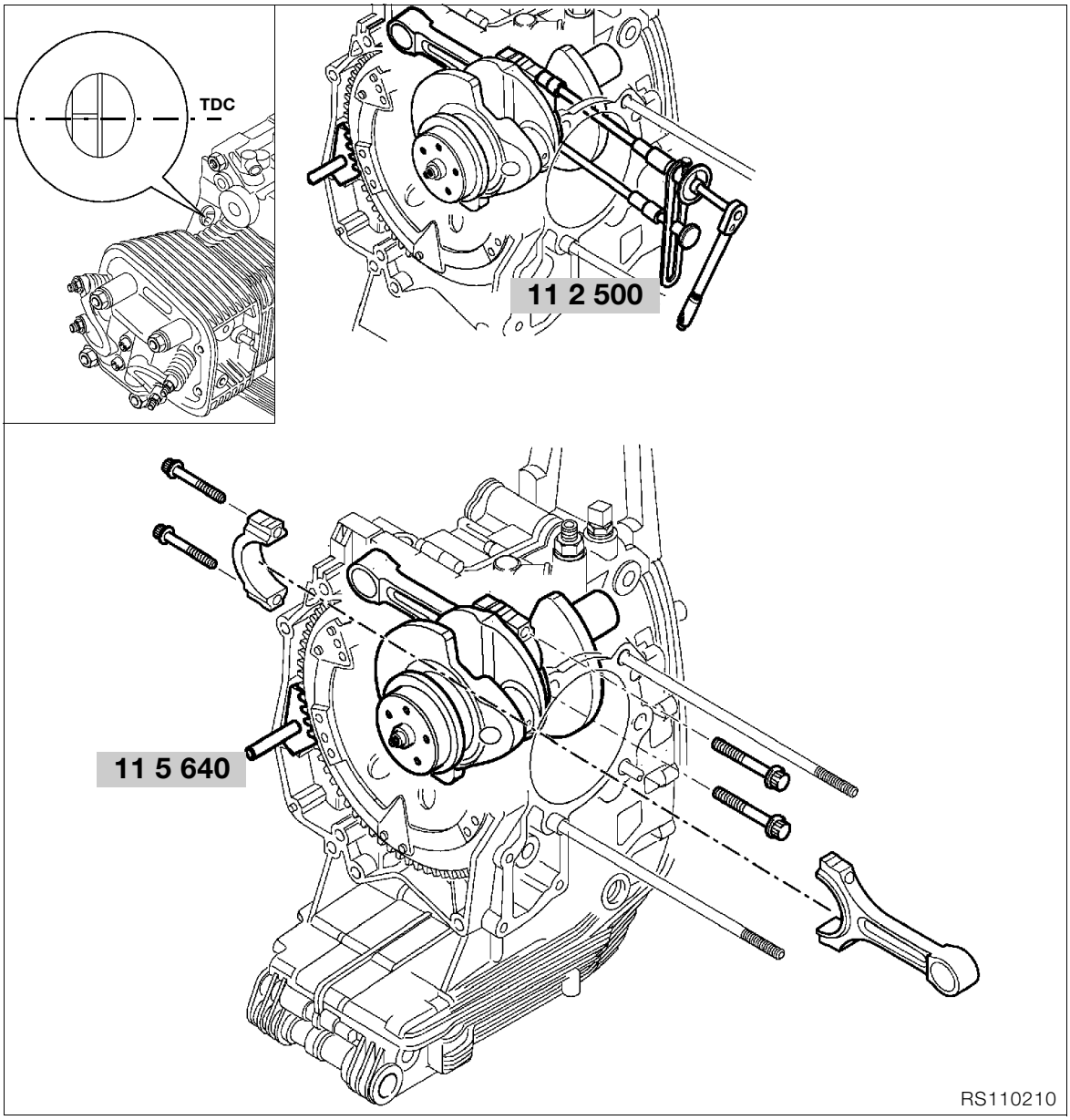
- Carefully fit piston rings to piston in the following sequence, using piston ring pliers:
  3rd groove - equal chamfer ring
  2nd groove - micro-chamfer ring
  1st groove - asymmetric, convex oval-section

➟ .....See Technical data

⚠ Caution:
The tubular-spring ring gap must be at 180° to the equal-chamfer ring gap.
Install with “Top” uppermost.







Removing/installing conrod

- Turn crankshaft to TDC position.
- Lock the clutch housing with special tool **BMW No. 11 5 640**.
- Remove conrod.

Note:
Conrods can also be removed/installed with the crankshaft removed.

Caution:
Do not accidentally interchange conrods or bearing shells.

- Install conrods.

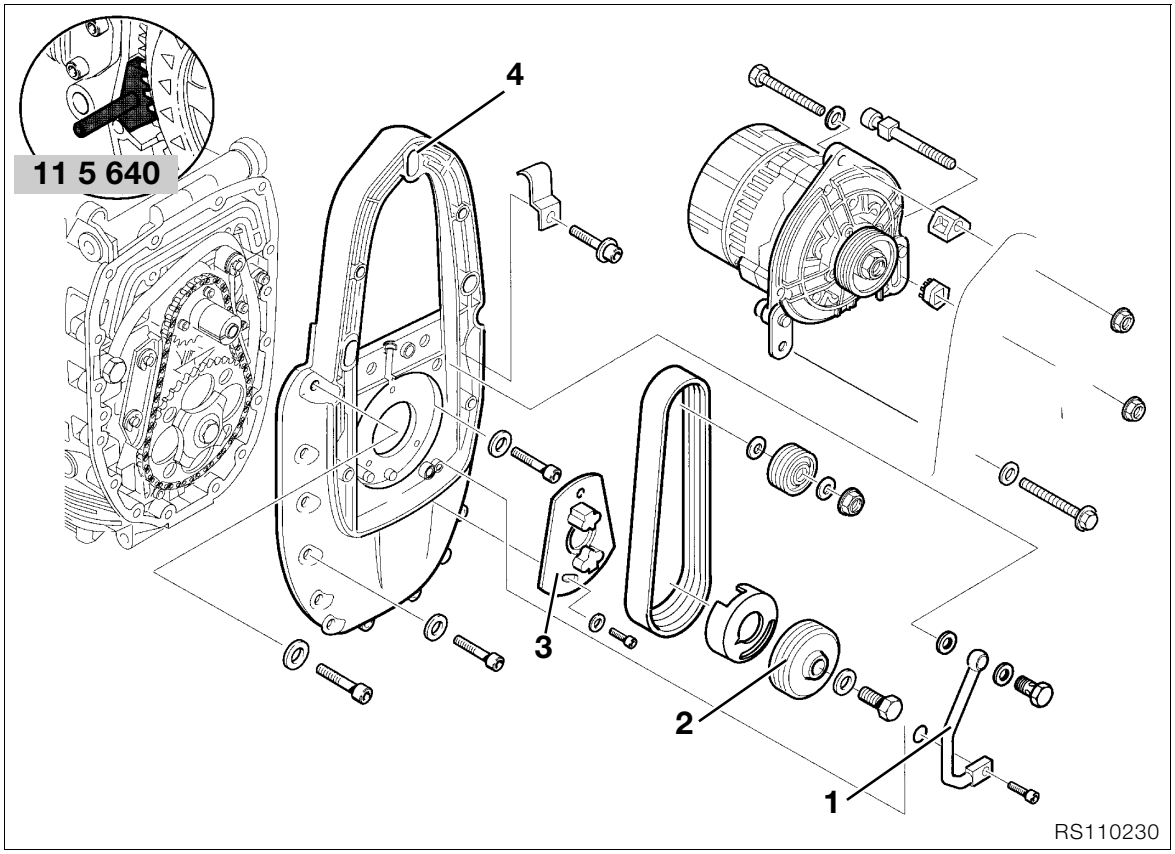
Installed direction of conrods:..lettering facing up

Caution:
Oil the bearings.

- Screw the big end bolts in by hand, then tighten them with a tightening angle indicator, **BMW No. 11 2 500**.

Caution:
Use big end bolts once only.

Tightening torque:
Big end bolts oiled
Joint torque..... 20 Nm
Wrench angle..... 80 °



Removing and installing alternator cover with engine installed

Caution:
Disconnect earth (ground) lead from battery.
Insulate earth (ground) lead.

- Detach the horn.
- Remove the oil cooler line.
- Separate the Hall-effect signal transmitter plug.
- Remove the starter motor.
- Remove rear leading link mount.

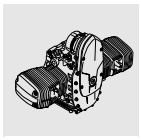
Removing alternator mount cover

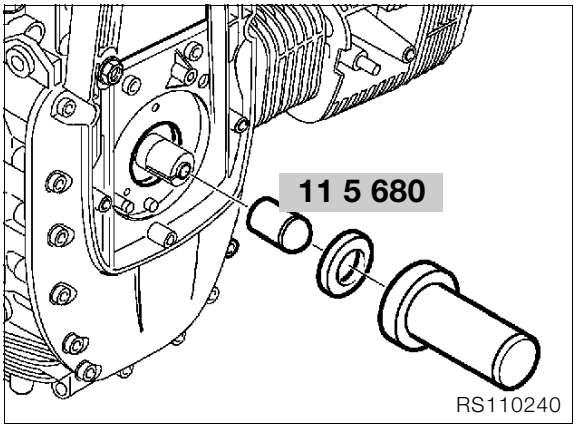
- Detach the alternator.
- Remove rotary breather line (1).
- Lock the clutch housing with special tool **BMW No. 11 5 640**.
- Remove pulley (2).
- Remove magnetic gate (3).

Note:
If complete alternator mount cover is removed, leave magnetic gate (3) installed.

- Remove alternator mount cover (4).

Renewing radial shaft seal in alternator mount cover

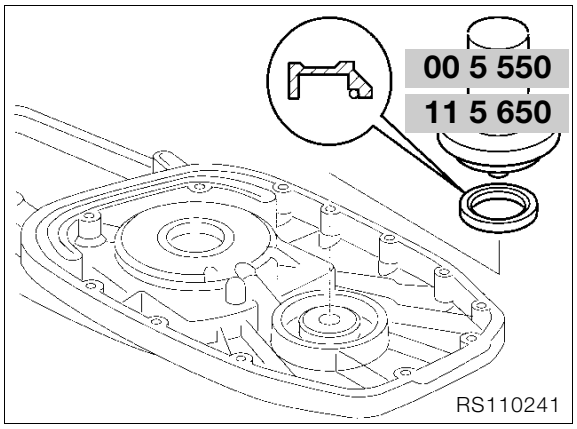




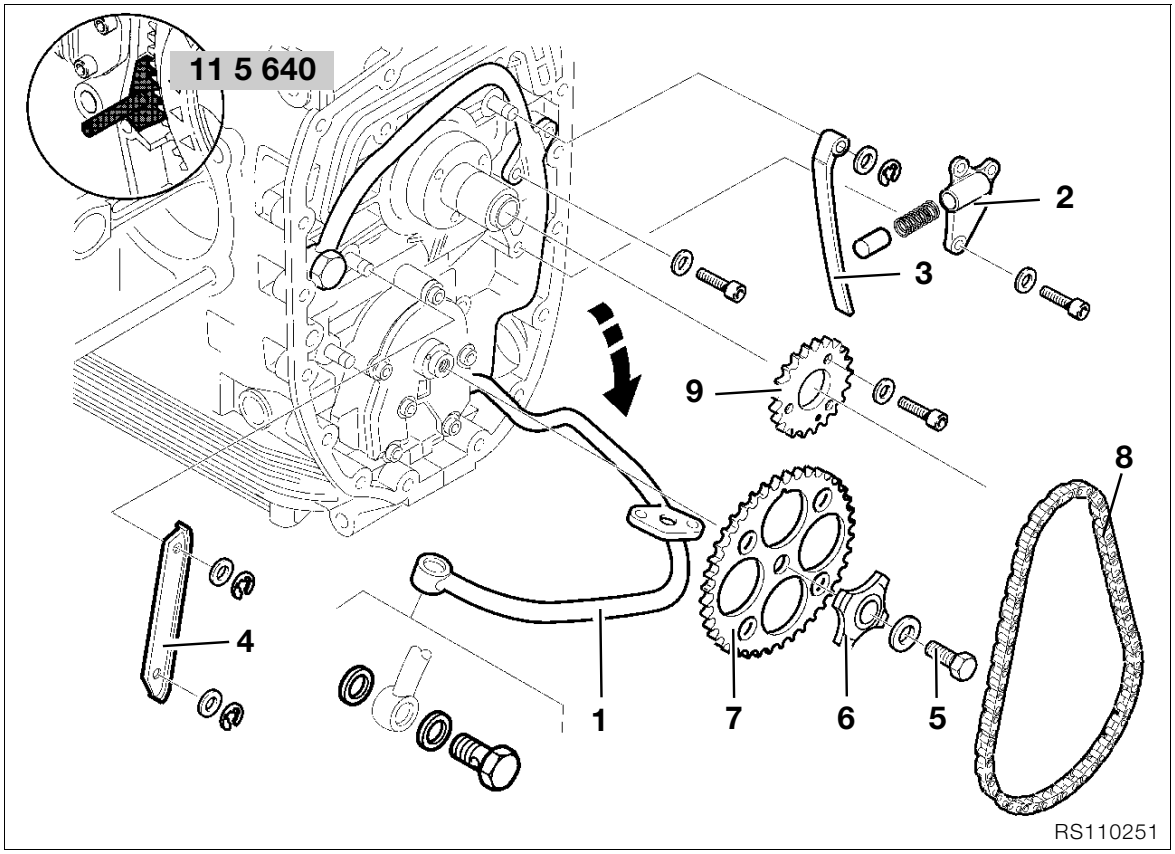
- Carefully lever radial shaft seal out, using a screwdriver.
- Drive in the new radial shaft seal with drift and sliding sleeve, **BMW No. 11 5 680**.

Note:
Slide new radial shaft seal over taper on sliding sleeve, pre-shape and pull off.

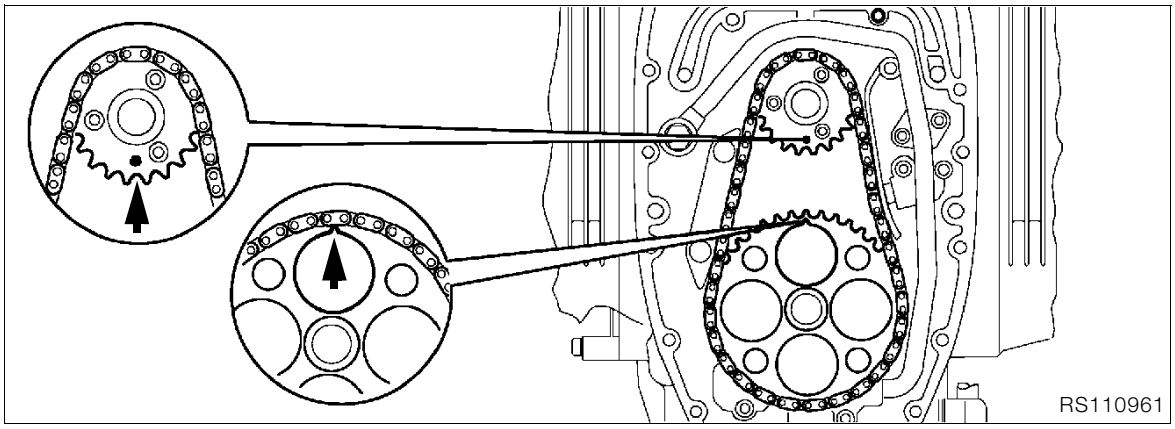
Renewing radial shaft seal for rotary breather



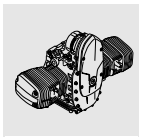
- Carefully lever radial shaft seal out, using a screwdriver.
- Carefully pre-form the lip of the radial shaft seal by hand.
- Oil the new radial shaft seal lightly and drive it in with handle, **BMW No. 00 5 550**, and drift, **BMW No. 11 5 650**.

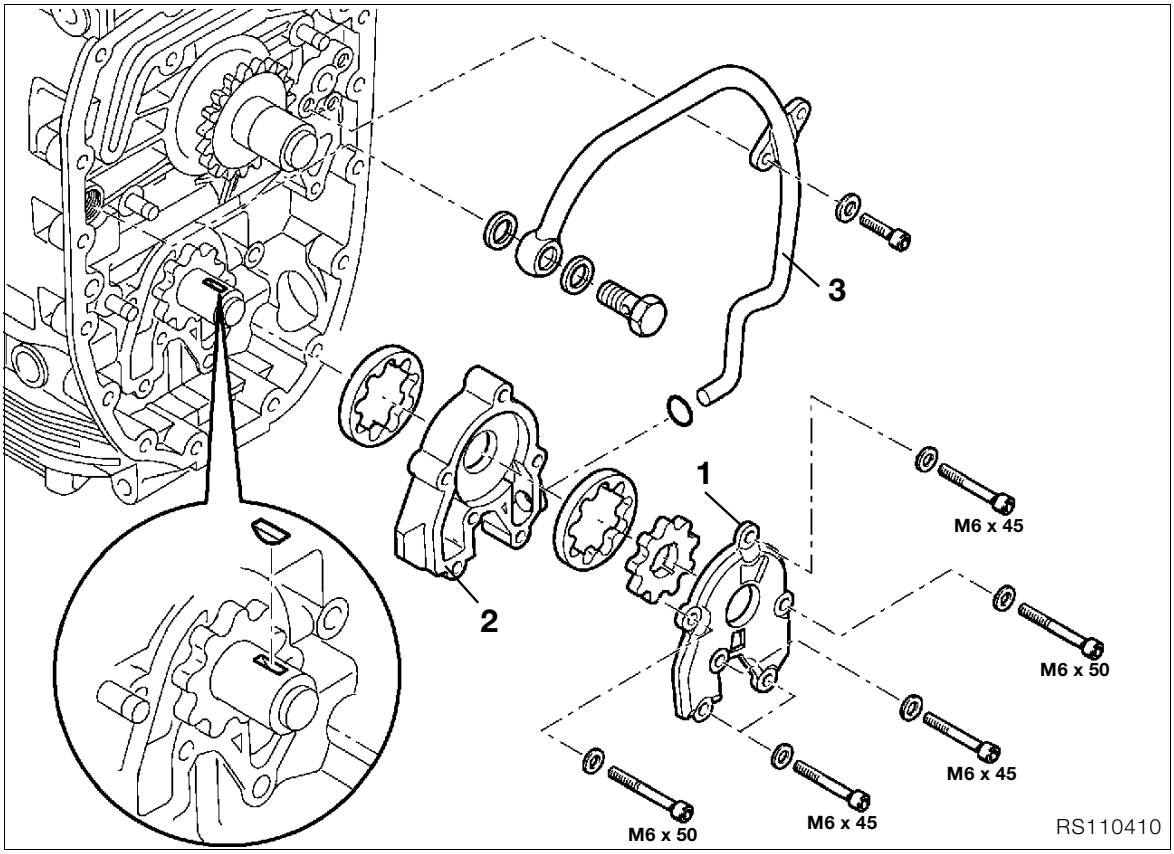


Removing auxiliary shaft drive



- Align markings (arrows) on timing pinion and chain sprocket.
- Unscrew and remove cooling oil pipe (1)/swing the pipe forwards.
- Remove chain tensioner (2).
- Remove chain tensioning rail (3).
- Remove chain guide rail (4).
- Lock clutch housing with special tool **BMW No. 11 5 640**.
- Unscrew and remove chain sprocket retaining bolt (5).
- Remove rotor (6) with chain sprocket (7) and timing chain (8).
- If necessary, remove chain sprocket (9).

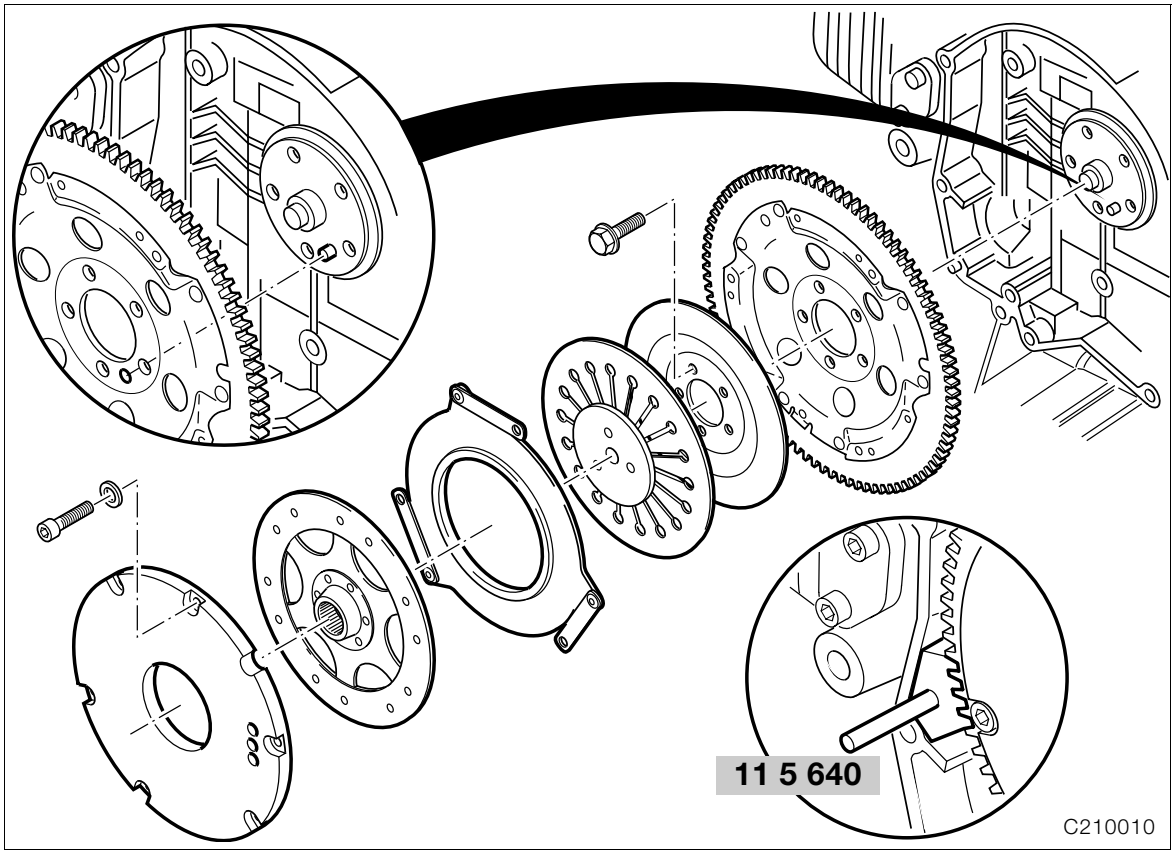




Removing oil pump

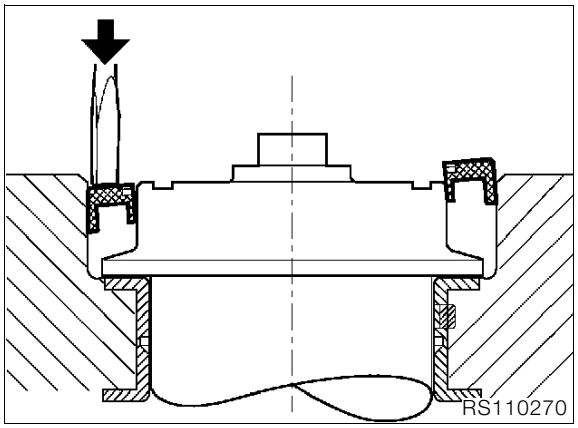
- Remove oil pump cover (1).
- Remove complete oil pump (2) together with cooling oil pipe (3), and dismantle.

⚠ Caution:
Check installed positions of parts which have already been run together.



Removing radial shaft seal on crankshaft with engine installed

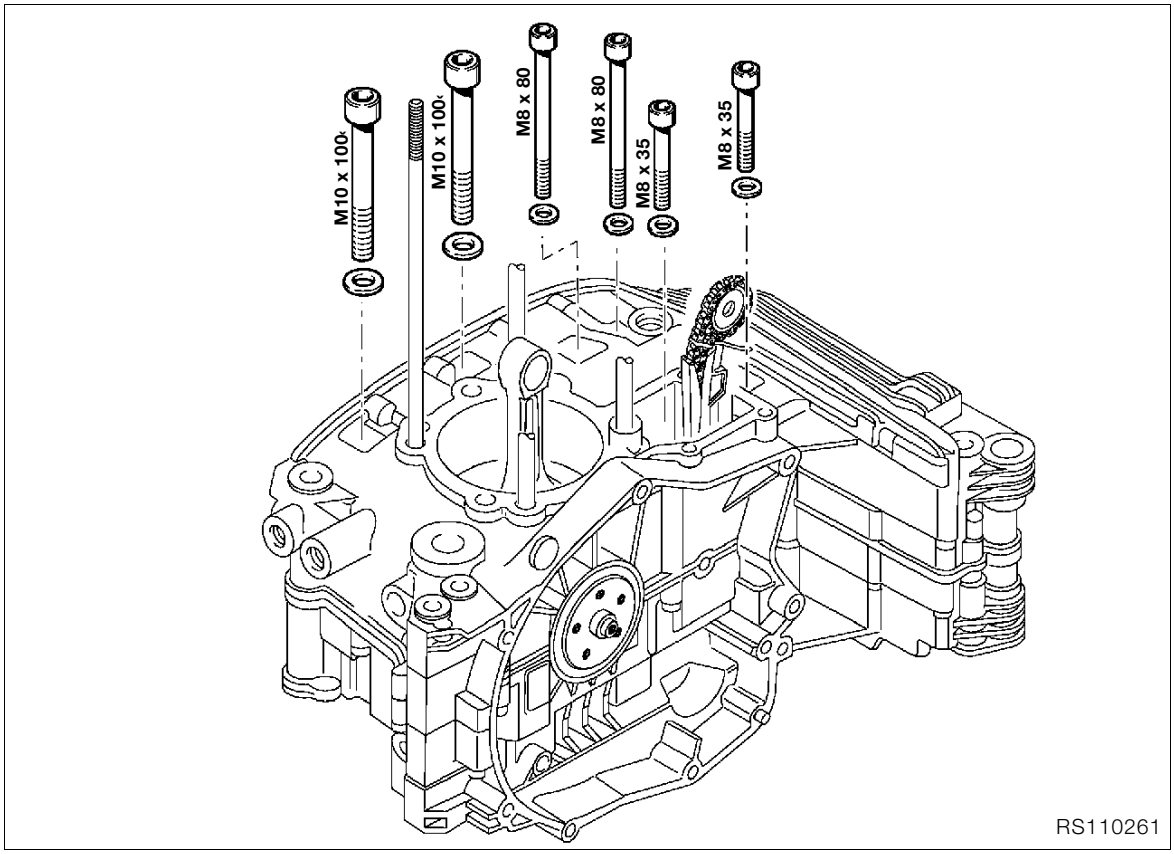
- Lock clutch housing with special tool **BMW No. 11 5 640**.
- Remove the clutch.



- Carefully lever radial shaft seal out, using a screwdriver.

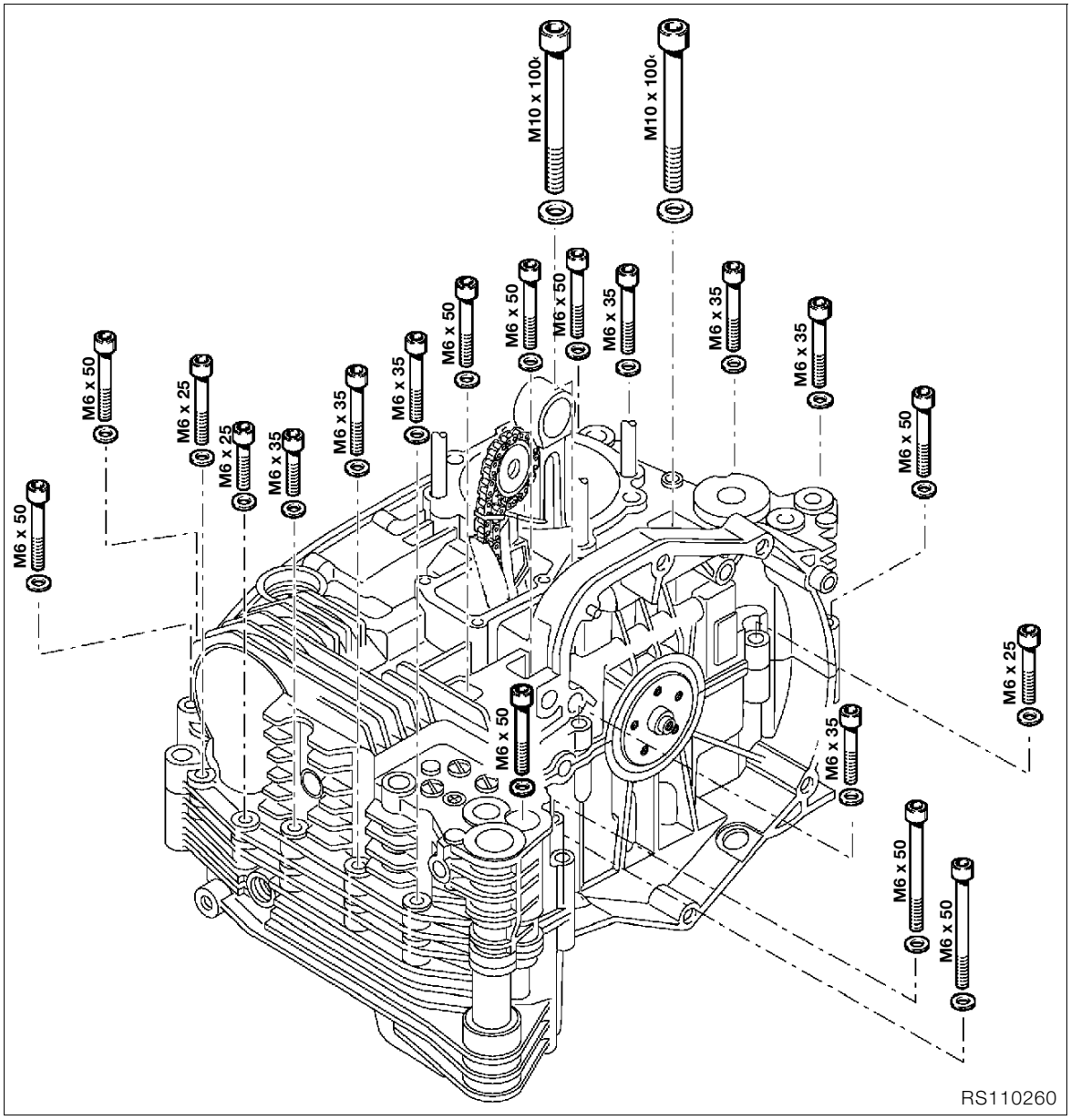
Caution:
Avoid damaging the sealing faces on the housing and the crankshaft.

Note:
When the crankcase is dismantled, the radial shaft seal can be taken out.

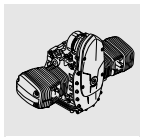


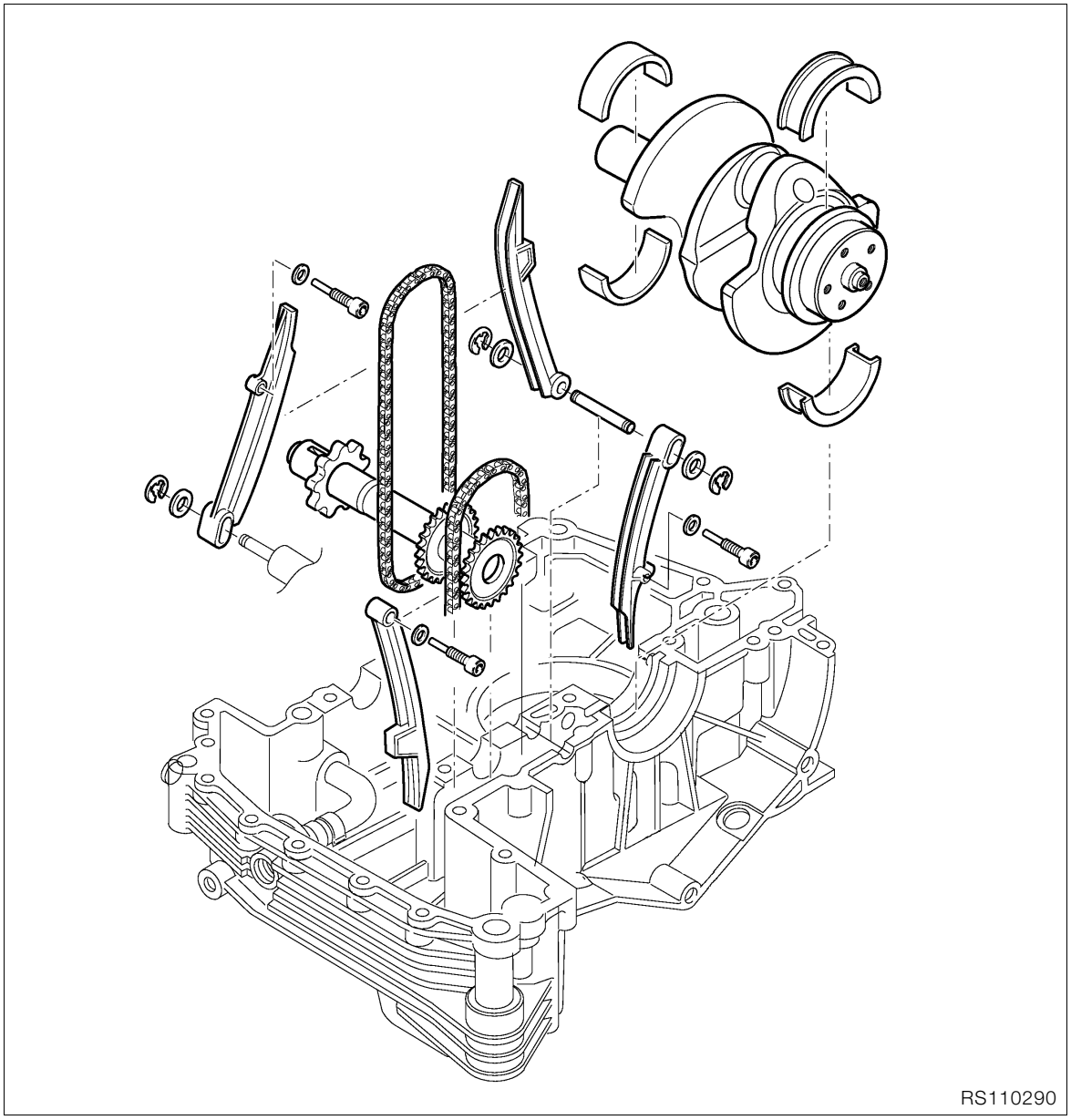
Dismantling crankcase

- Turn engine on to its side.
- Remove screws on right side.



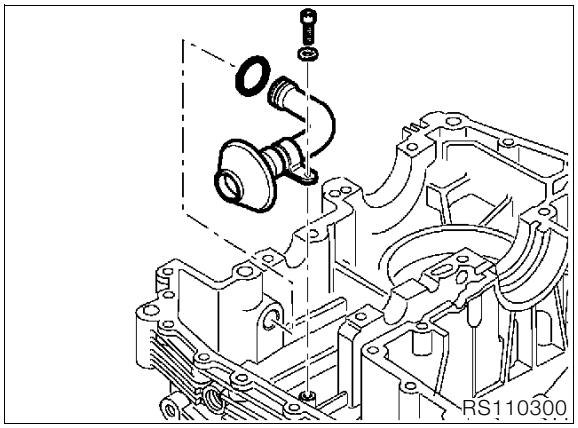
- Turn engine on to its side.
- Remove screws on left side.
- Remove upper section of crankcase.





Removing crankshaft, auxiliary shaft and timing chain tensioning and slide rails

Removing and installing oil pick-up basket



Tightening torque:
M 6 screw ..... 9 Nm

Caution:
Make sure that the O-ring is not omitted, and is installed undamaged.

Replacing oil level sight glass

- Pierce the plastic disc with a large screwdriver and lever out the oil level sight glass.
- Coat the sealing face of the new oil level sight glass with engine oil and drive it in with drift, **BMW No. 00 5 550.**

Removing conrods

- Clamp crankshaft in a vise provided with protective jaws.
- Remove conrod.

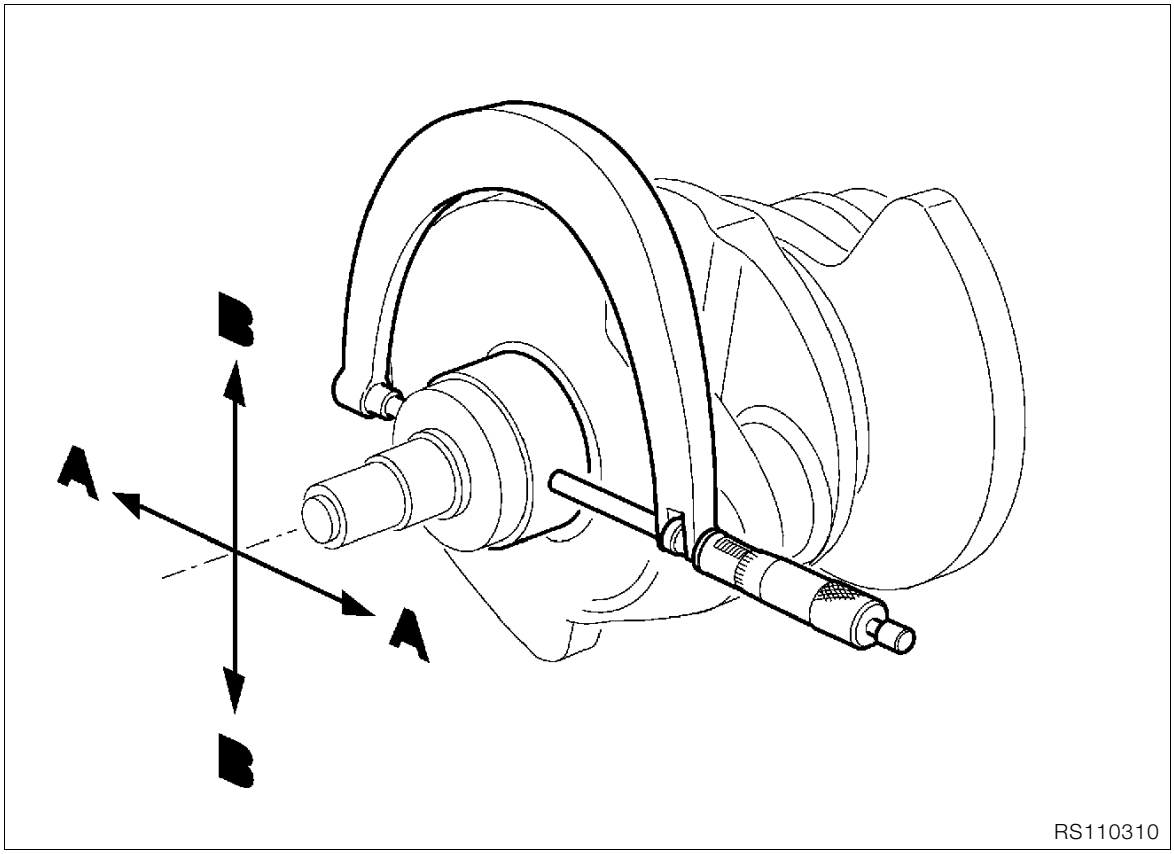
Caution:
Do not accidentally confuse the conrods.

Checking conrods

- Check conrod dimensions.

..... See Technical data

Caution:
Sintered-metal conrods must never be straightened – risk of fracture.



Measuring main and big end bearing play

Measuring radial bearing play

- Measure main bearing journal with an external micrometer crosswise in two planes, A and B.
- Enter measured values on record sheet.

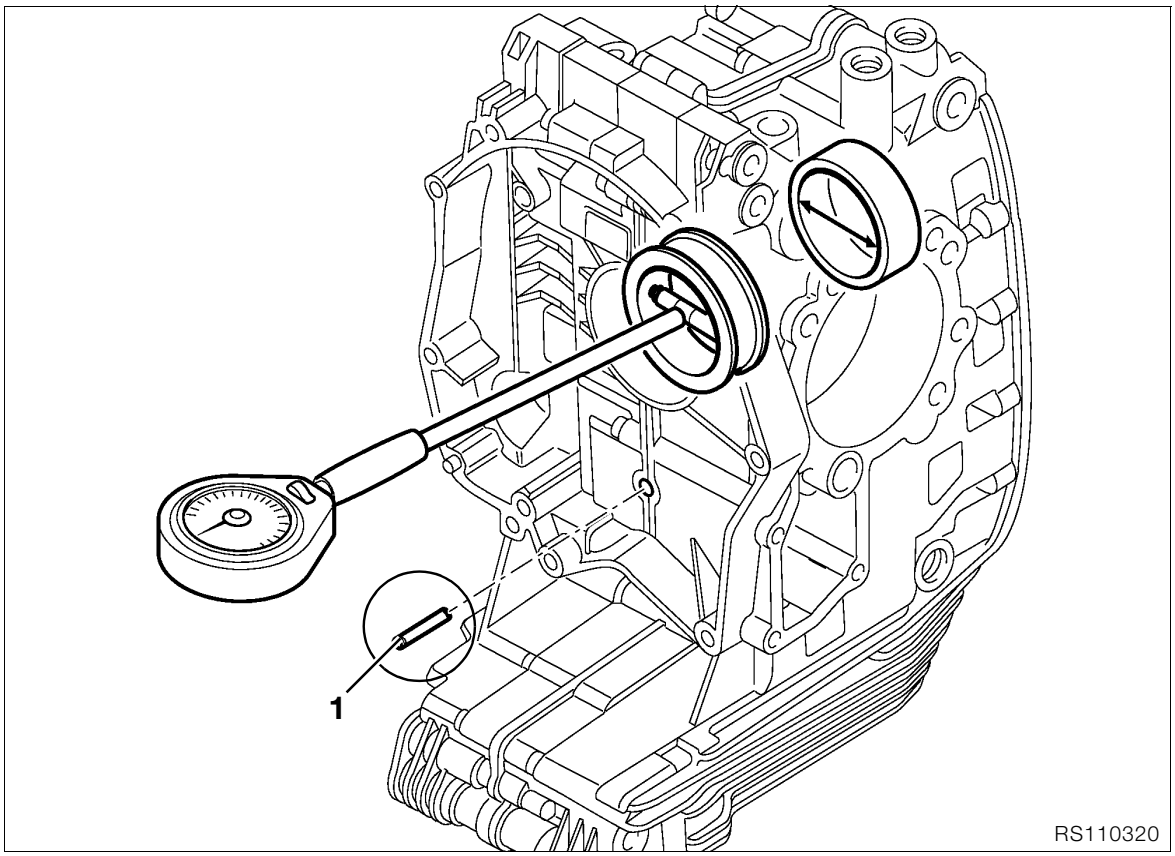
➠ .....See Technical data

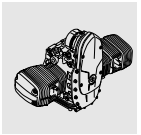
Caution:

The crankshaft can only be reground in grinding stage 0; after this it must be rehardened and finished. Grinding stages are identified by a paint mark on the front crank web.

➠ .....See Technical data

If the bearing shells have to be replaced, note colored marks on crankpins and big end bearings.





Installing main bearing

- Insert tensioner rail/slide rail pivot pin (1) for centering purposes.
- Tighten M8 and M10 housing screws.

Tightening torque/tightening order:

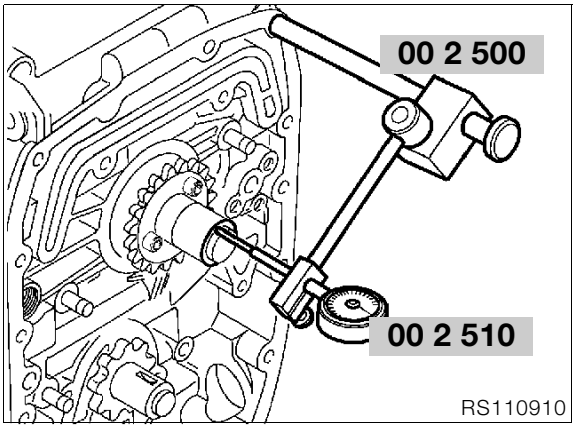
1. M 10 screw (oiled) ..... 45 Nm
2. M 8 screw (oiled) ..... 20 Nm

- Measure main bearings front/back in the load direction.
- Enter measured values on record sheet and determine main bearing play values.

➡ .....See Technical data

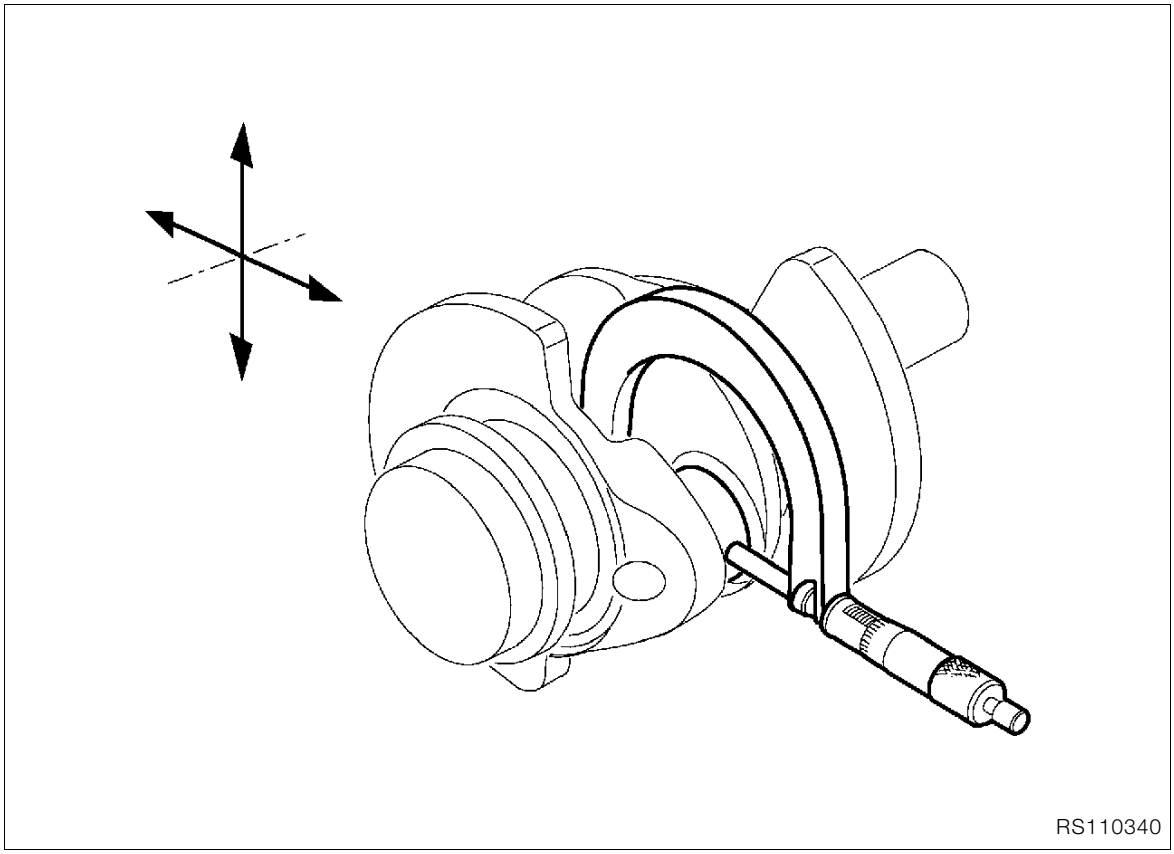
Measuring axial bearing play

- Place crankshaft in engine block.
- Insert tensioner rail/slide rail pivot pin (1) for centering purposes.
- Tighten housing screws.



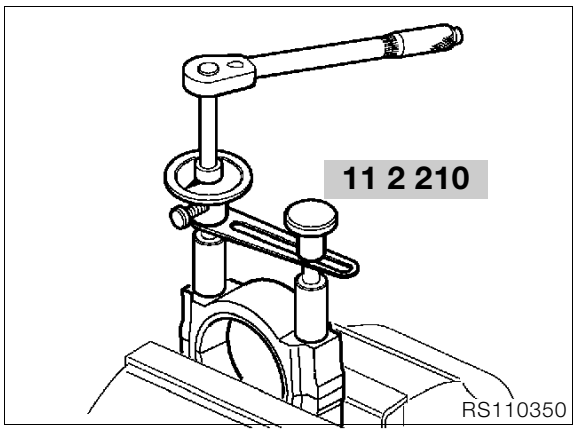
- Screw measuring device, **BMW No. 00 2 500**, with dial gauge, **BMW No. 00 2 510**, into tapped hole for alternator carrier cover.
- Move crankshaft forwards and backwards and read off play at dial gauge.

➡ .....See Technical data



Measuring big end bearing play

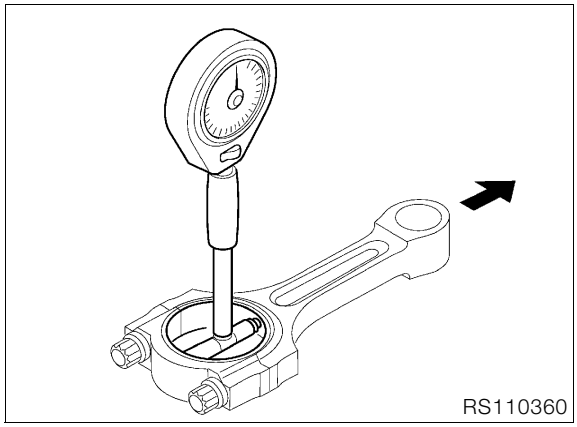
- Measure crankpin with an external micrometer in the thrust direction and offset through 90°.



- Install bearing shells and assemble conrods.
- Using tightening angle gauge, **BMW No. 11 2 210**, tighten the big end bolt.

Tightening torque:

Big end bolts oiled
Joint torque ..... 20 Nm
Wrench angle ..... 80°

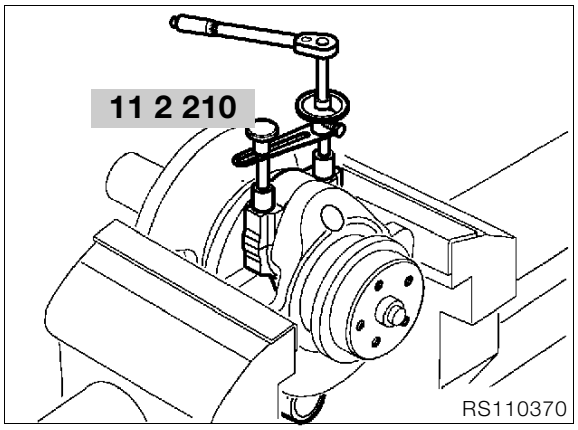


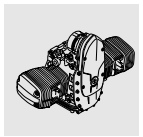
- Measure big end bearing with internal gauge in thrust direction.
- Enter measured values on record sheet and determine big end bearing clearances.

➠ ..... See Technical data

Assembling engine

Installing conrod



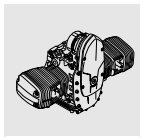


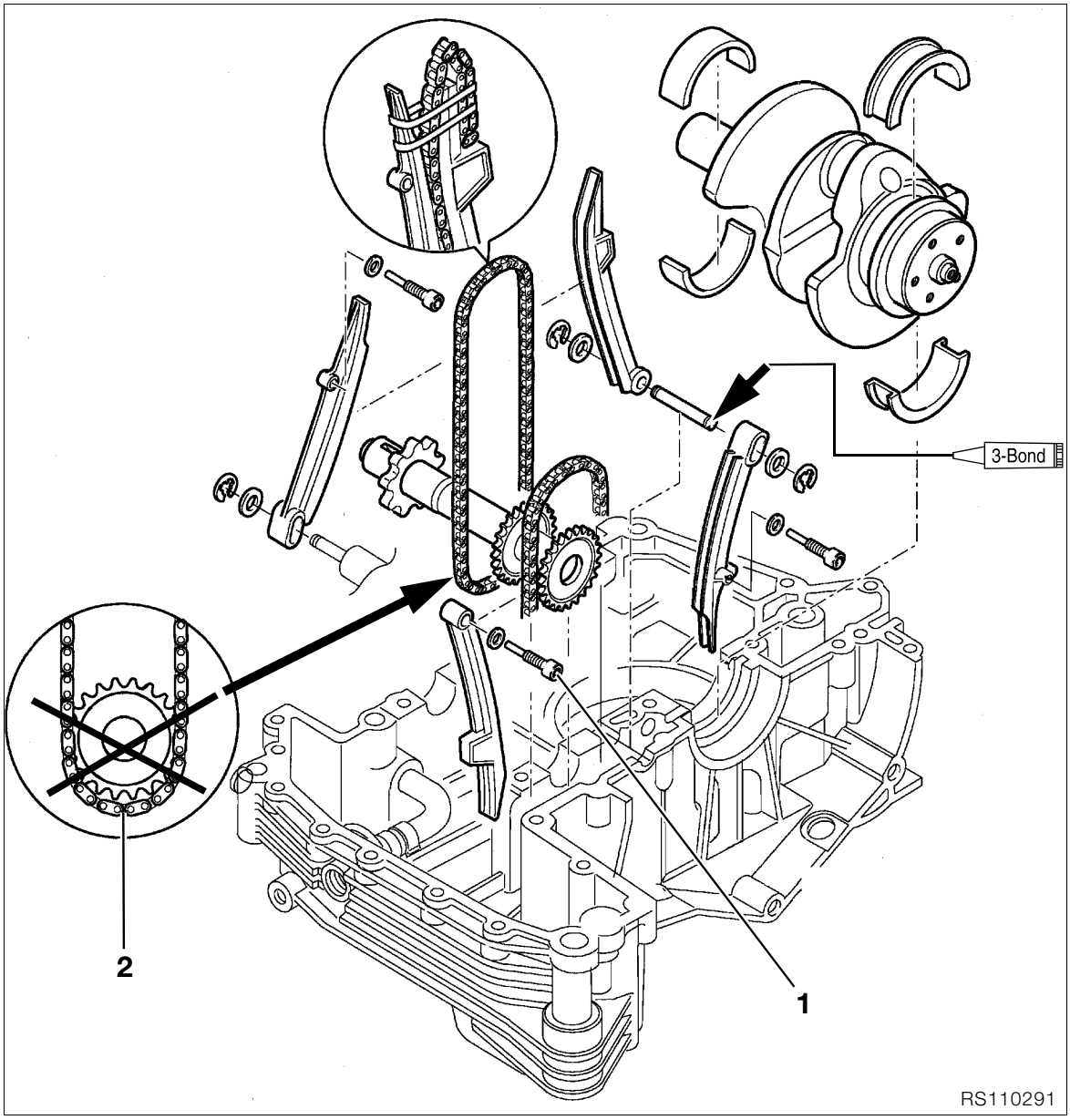
- Clamp crankshaft in a vise provided with protective jaws.
- Oil the big end bolts, screw them in by hand and tighten with angle gauge, **BMW No. 11 2 210**.

Caution:
Oil the bearings.
Do not accidentally confuse conrods or bearing shells.
Always use new big end bolts.

Installed direction of conrods: ..lettering facing up

Tightening torque:
Big end bolts (oiled)
Joint torque ..... 20 Nm
Wrench angle ..... 80°





Installing crankshaft

Caution:
Oil the bearings.

Installing timing chain tensioning and slide rails

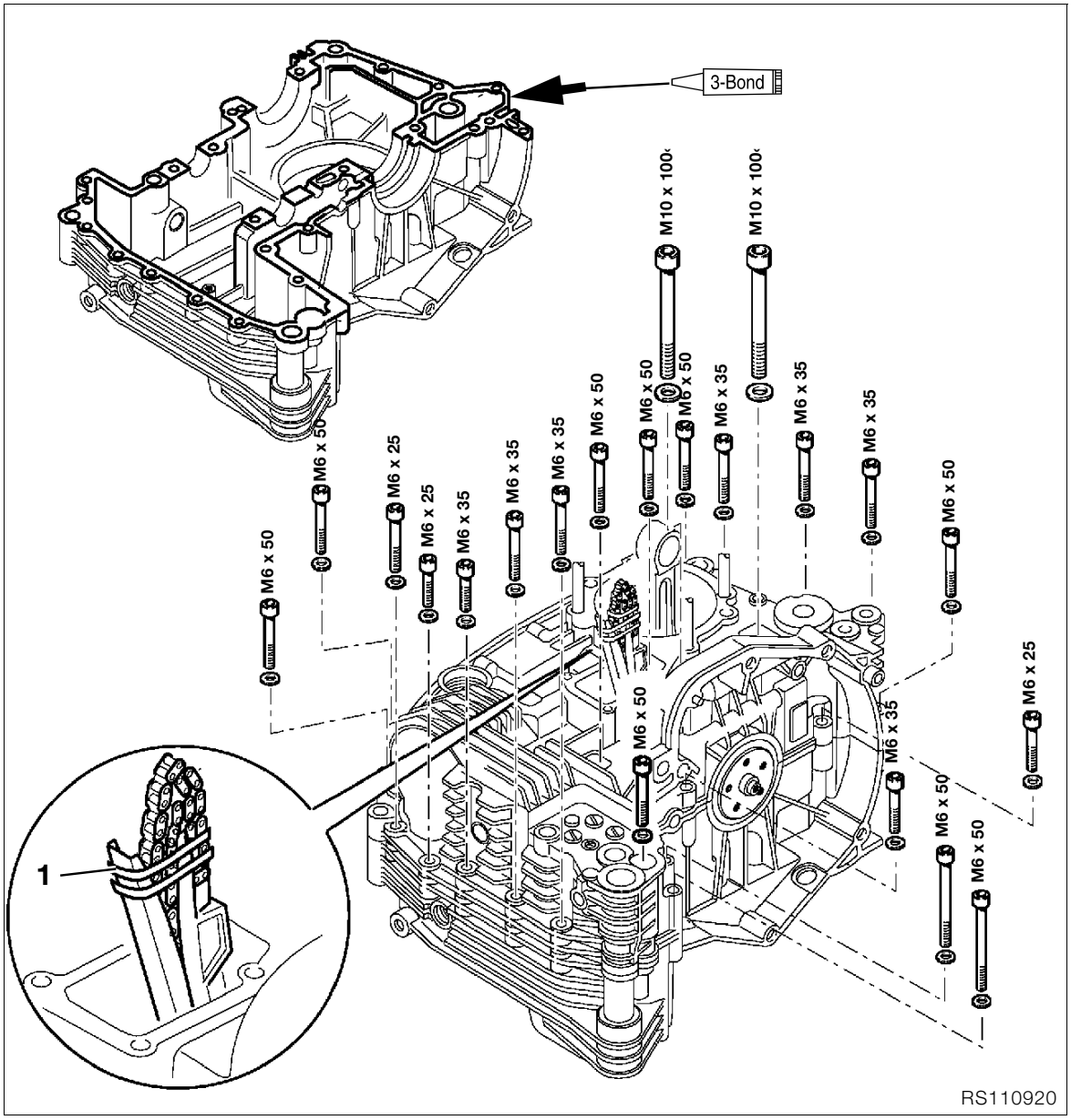
- Seal pivot pin for tensioning rail/slide rail at clutch side (arrow) with **3-Bond 1209**.

Insert pivot screw (1) into chain tensioner rail, using a new seal.

Tightening torque:
Chain guide rail pivot pin ..... 18 Nm

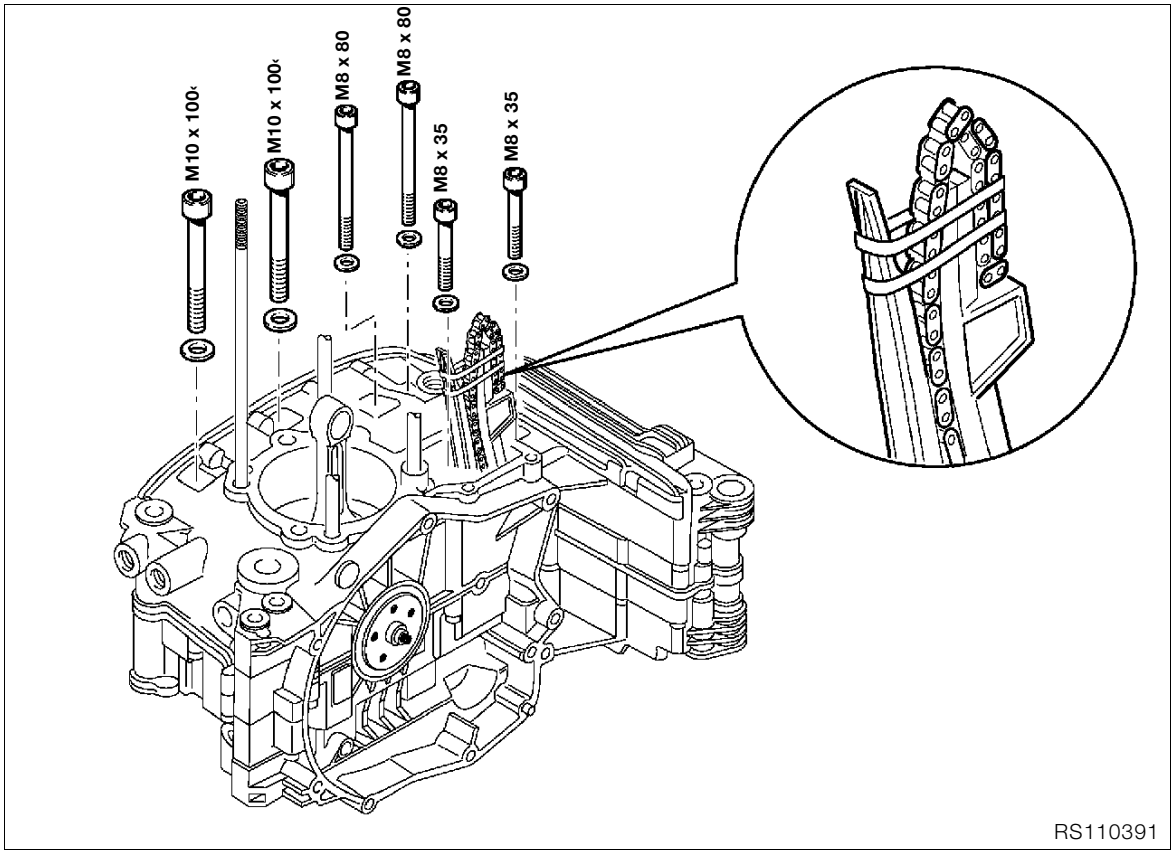
Installing auxiliary shaft/timing chains

Caution:
Timing chains (2) must mesh fully with auxiliary shaft sprockets.



Assembling engine block

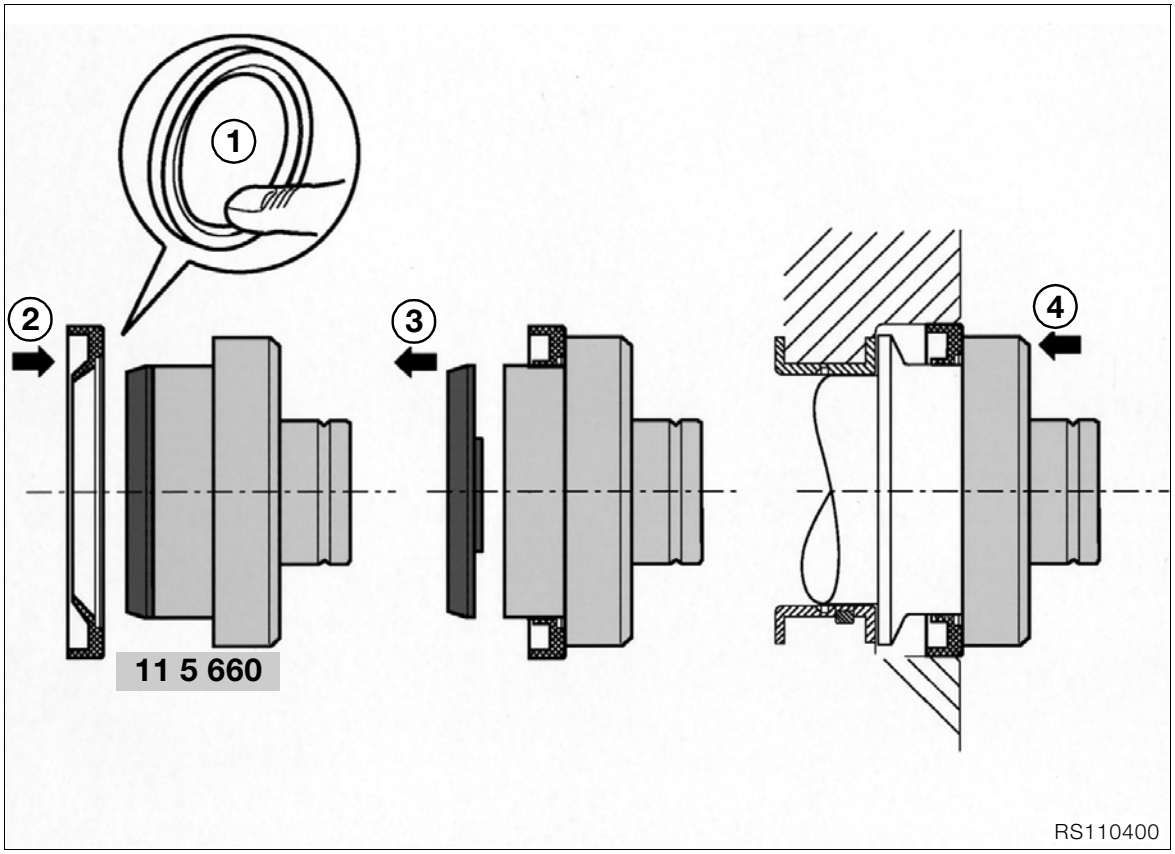
- Coat clean, grease-free sealing faces (arrow) with **3-Bond 1209**.
- Secure the timing chain with rubber band (1) to the timing chain tensioning and slide rail.

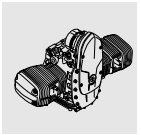


- Bolt the crankcase sections together.

Tightening torque/tightening order:

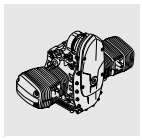
1. M10 screw (oiled) ..... 45 Nm
2. M 8 screw (oiled) ..... 20 Nm
3. M 6 screw ..... 9 Nm

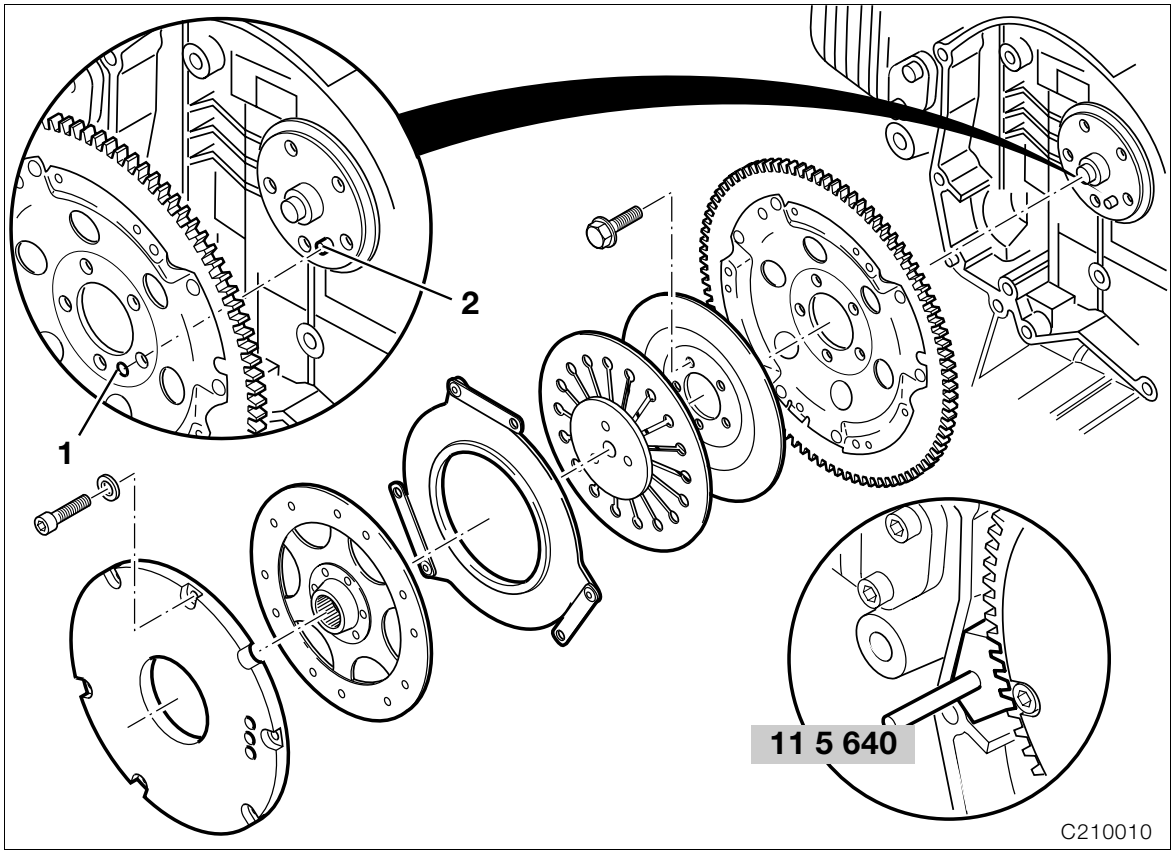




Installing the crankshaft radial seal

- Pre-form the lip of the radial shaft seal carefuilly by hand (1).
- Oil the radial shaft seal at the sealing/contact surface.
- Place radial seal over sliding sleeve (2)/remove sliding sleeve (3).
- Drive the radial shaft seal in with handle, **BMW No. 00 0 500**, and drift with sliding sleeve, **BMW No. 11 5 660** (4).





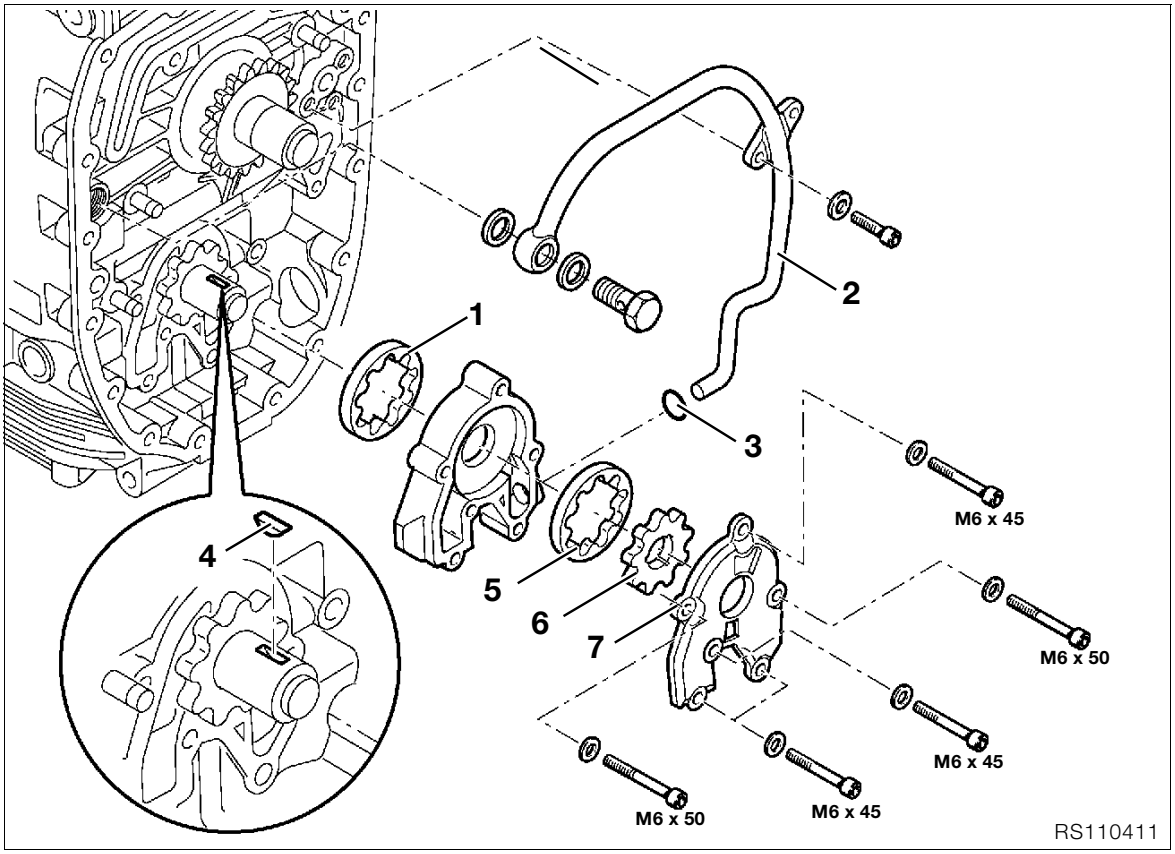
Installing clutch housing

Caution:
Always use new bolts for housing and cover.

- Install clutch housing with mark (1) aligned with crankshaft mark (2).
- Lock the clutch housing with special tool **BMW No. 11 5 640**.
- Insert all screws by hand and tighten down.

Tightening torque:

Clutch housing
to crankshaft (screw threads oiled) ..... 40 Nm
Additional wrench angle ..... 32°



Installing oil pump

Caution:
Oil the sliding-contact faces.

- Install outer rotor (1) of oil pump in pump housing.
- Install oil pump housing with cooling oil pipe (2).

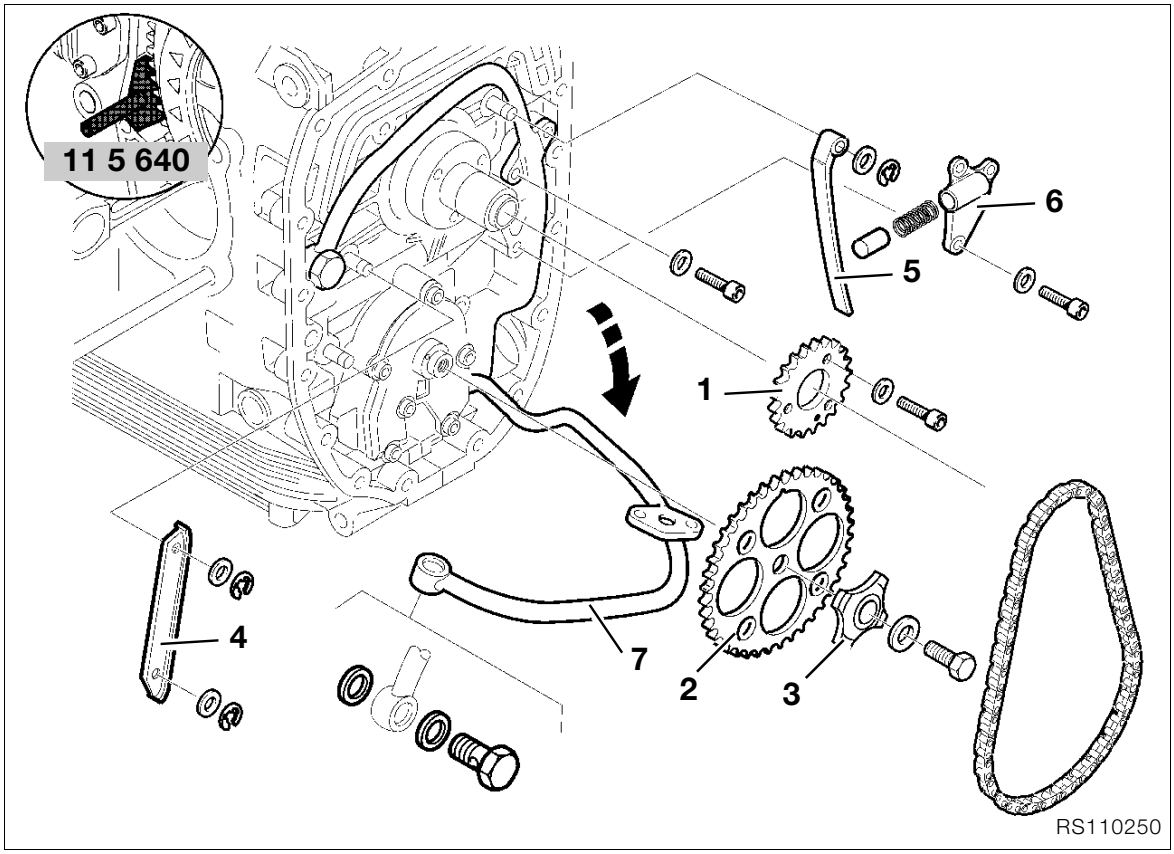
Caution:
O-ring (3) must be in good condition.

- Install Woodruff key (4), outer rotor (5) and inner rotor (6) in cooling oil pump.
- Screw housing cover (7) on to oil pump.

Caution:
Note different lengths of screw.

Tightening torque:

M 6 screw ..... 9 Nm
Pressure relief valve ..... 35 Nm
Oil pressure switch..... 30 Nm



Installing auxiliary shaft drive

- Set crankshaft mark against mark on auxiliary shaft.

Caution:
Adjust according to the adjusting instructions.
➟ ..... See “Installing cylinder head”.

- Lock the clutch housing with special tool **BMW No. 11 5 640**.
- Install chain sprocket (1).

Tightening torque:
M 6 screw ..... 10 Nm

- Install drive-shaft chain with chainwheel (2) and rotor (3).

Tightening torque:
Retaining screw at chainwheel ..... 70 Nm

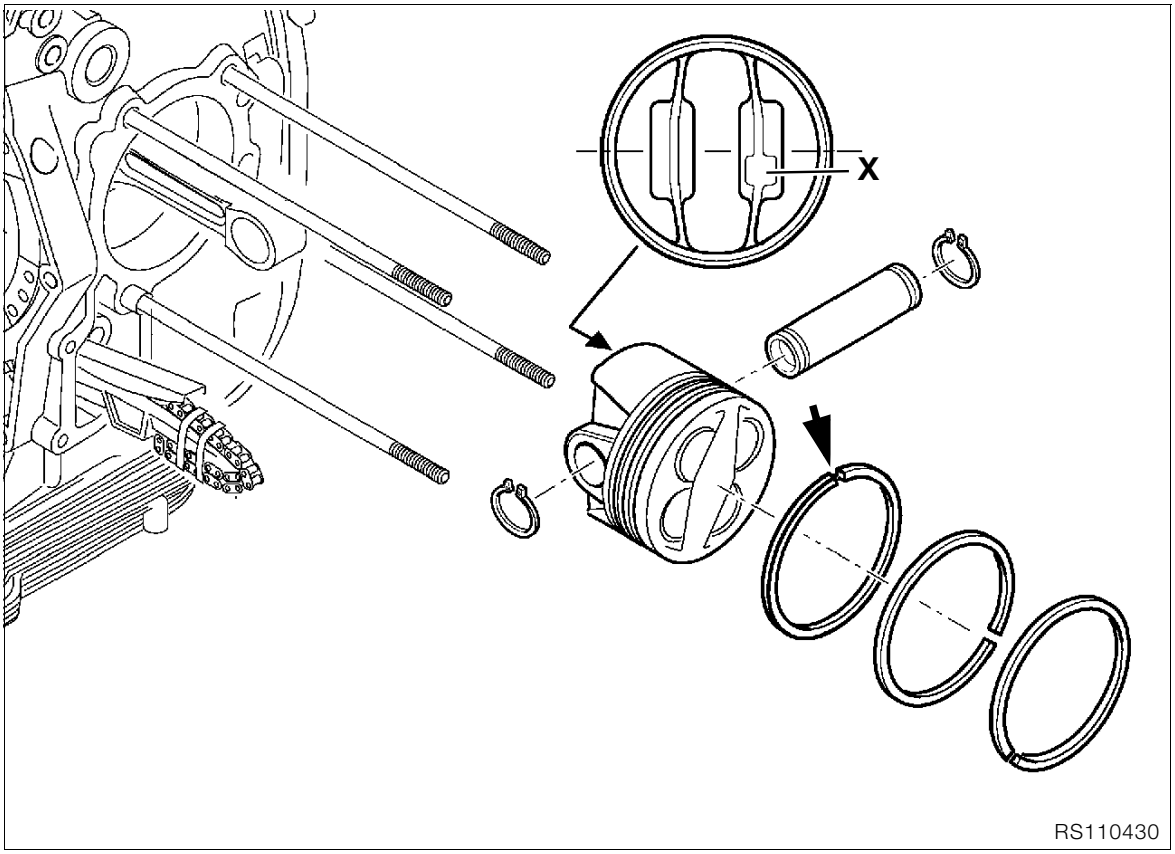
- Install/secure chain guide rail (4).
- Install/secure chain tensioner rail (5).
- Install chain tensioner housing (6) with piston and spring.

Tightening torque:
M 6 screw ..... 9 Nm

- Tighten down cooling oil line (7).

Caution:
Use a new sealing ring.

Tightening torque:
M 6 screw ..... 10 Nm
Banjo screw for cooling oil line
with oil vent valve ..... 25 Nm



Installing piston

- Turn joint in oil scraper ring (arrow) so that it faces upwards.
- Install piston ring gap offset by 120° in each case.

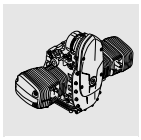
Production locating point **X** = install on exhaust side.

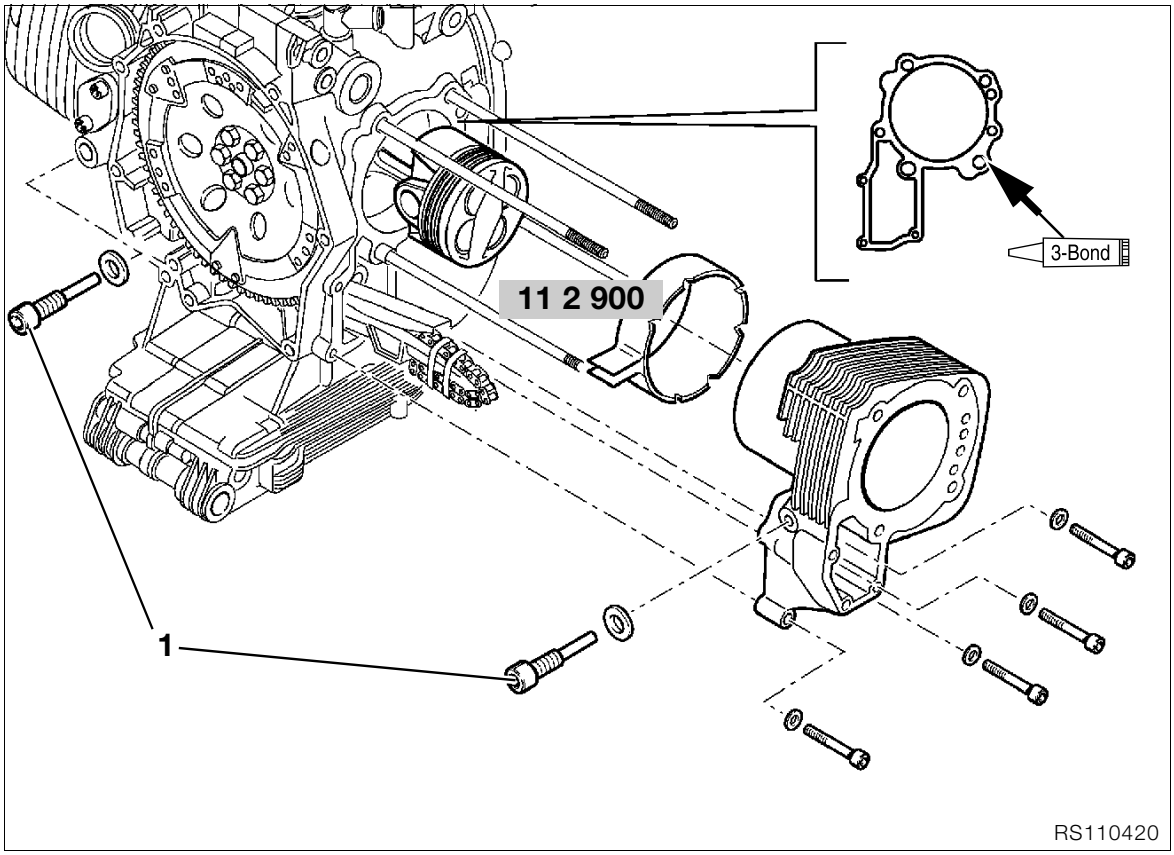
Caution:
Ensure that retaining rings are properly seated on piston pin.
Oil the sliding-contact faces.
Always use pistons of the same weight class in any one engine.

Markings: ..... + or –
➠ .....See Technical data

Caution:
Always install pistons and cylinders in pairs.
Do not accidentally confuse pistons or piston pins.

Piston size identification:
On piston crown A, B, AB (for either A or B cylinder), and on cylinder A, B.



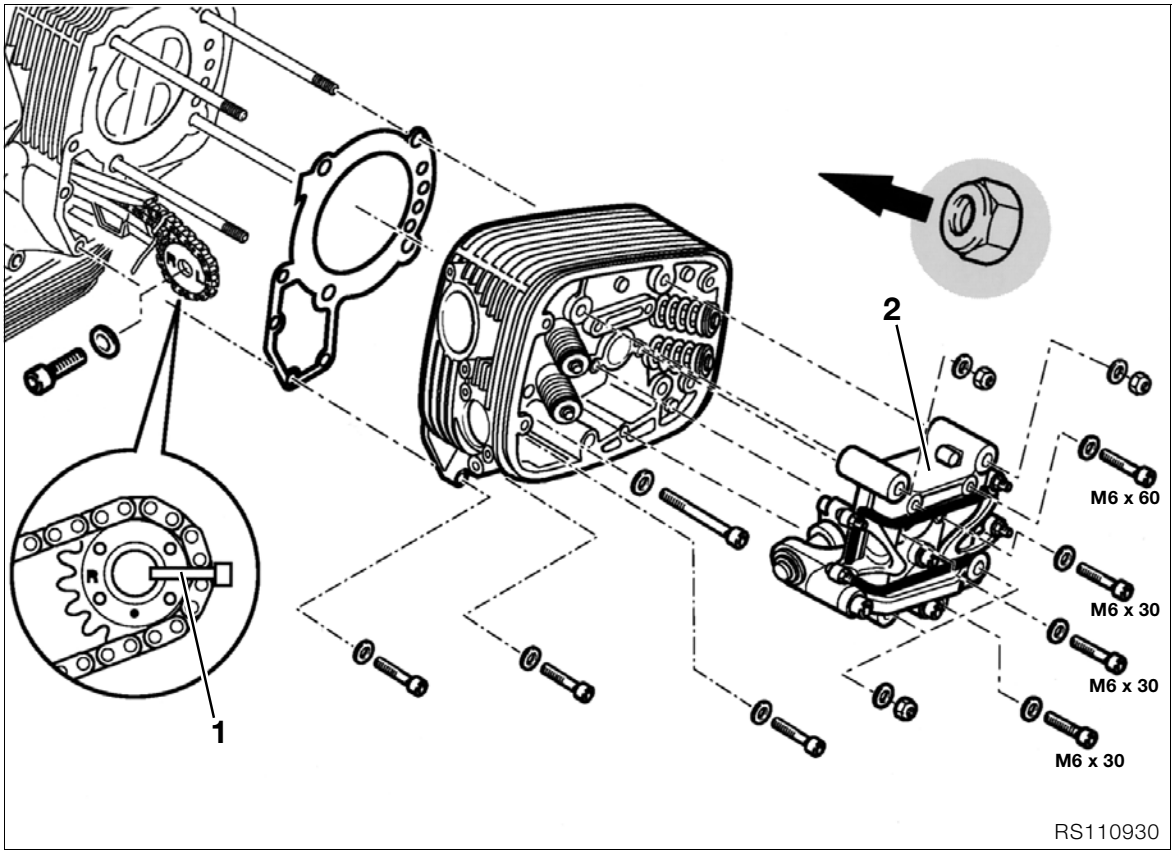


Installing cylinder

- Apply **3-Bond 1209** to the cylinder base sealing face (arrow), which must be clean and free from grease.
- Oil the cylinder wall.
- Compress the piston rings with a clamping strap, **BMW No. 11 2 900**.
- Install the cylinder and at the same time pass the timing chain and the tensioning and guide rail through the timing case cavity.
- Tighten cylinder down firmly.
- Fit new seal to pivot pin for chain guide rail (1).
- Install chain sprocket.

Tightening torque/tightening order:

1. M 8 screw ..... 20 Nm
2. M 6 screw ..... 9 Nm
3. Pivot screw for chain guide rail..... 18 Nm



Installing cylinder head

- Install cylinder head gasket.
- Fit cylinder head/insert correctly positioned camshaft chain sprocket (1) and timing chain into chain cavity.
- Install valve gear support (2).
- Tighten cylinder head down.

Caution:
Install collar (arrow) of cylinder head nut towards cylinder head.

Tightening torque/tightening order:

1. Tighten cylinder head nuts (oiled) crosswise
1.1 Tighten all nuts ..... 20 Nm
1.2 Tighten all nuts to correct angle ..... 90°
1.3 Tighten all nuts to correct angle ..... 90°
2. M 10 bolt ..... 40 Nm
3. M 6 screw ..... 9 Nm

Tightening torque:

Take up slack after 1000 km (app. 600 miles)
Tighten cylinder head nuts in a crosswise pattern

1. Unfasten one nut
2. Tighten one nut to initial value ..... 20 Nm
3. Tighten nut to wrench angle ..... 180°
4. Unfasten/retighten M10 screw ..... 40 Nm

- Fit camshaft chain sprocket in accordance with adjustment specification.
- Lock clutch housing with special tool **BMW No. 11 5 640**.
- Tighten camshaft chain sprocket.

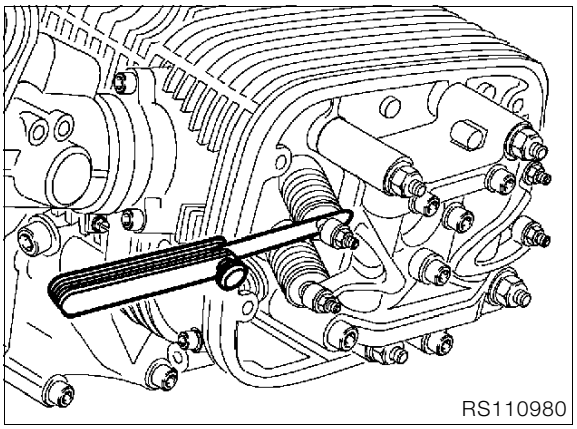
Tightening torque:

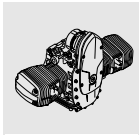
Camshaft sprocket retaining screw ..... 65 Nm

- Insert the left-side camshaft sprocket with pin into the camshaft and set the left cylinder to TDC on the ignition stroke.
- Fit camshaft chain sprocket in accordance with adjustment specification.
- Tighten camshaft chain sprocket.
- Install chain tensioner.
- Check that marks on camshaft sprockets are in accordance with adjustment specification.

Tightening torque:

Chain tensioner ..... 32 Nm





Adjusting valve clearances

- Set piston to TDC on the ignition stroke.
- Measure valve clearance with feeler gauge.
- Correct valve clearance with adjusting screw and lock into position.

Valve clearances with engine cold (max. 35 °C/95 °F):

Inlet ..... 0.15 mm (0.006 in)
Exhaust ..... 0.30 mm (0.012 in)

Tightening torque:

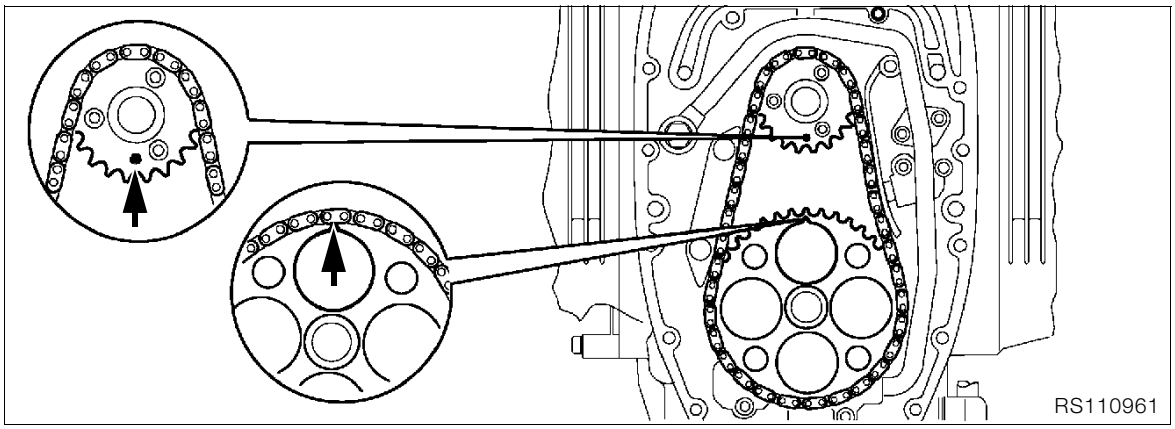
Locknut ..... 8 Nm

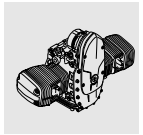
- Check valve clearance again; it must be possible to insert the feeler gauge between valve stem and rocker with only slight resistance to movement.

Installing right cylinder head

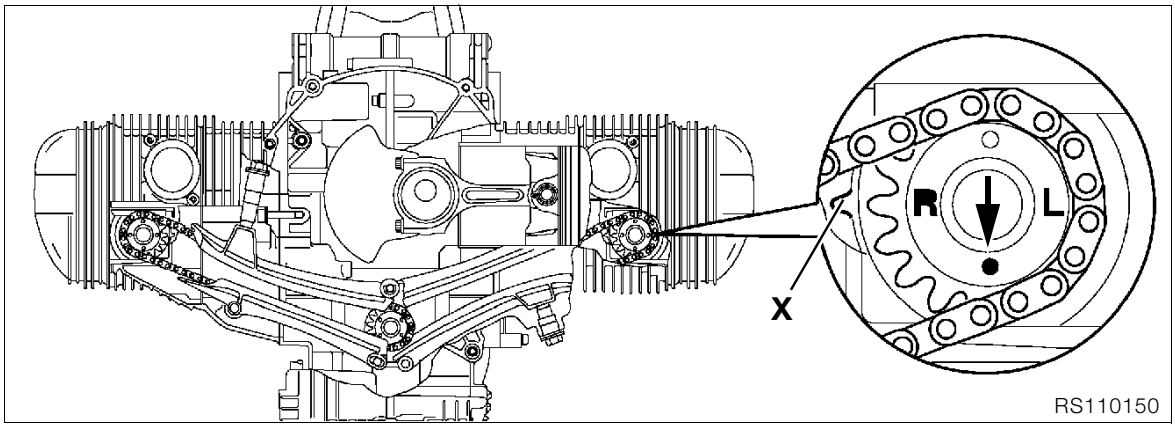
Adjustment specification

Caution:
When assembling, **always** start with the **right** cylinder.





Right cylinder = at TDC on ignition stroke:
marks (arrows) on chainwheel/auxiliary shaft and chain sprocket/crankshaft are aligned.



- Locate ignition-stroke TDC with insert pin, **BMW No. 11 2 650**, at hole in clutch housing and engine block.

Note:
With the engine installed, adjust TDC with dial gauge holder, **BMW No. 00 2 650**, and dial gauge, **BMW No. 00 2 510**.

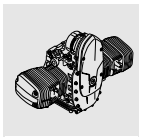
Right cylinder = at TDC on ignition stroke:
Locating pin (arrow) on right camshaft sprocket points downwards.
Mark (**R** or **arrow**) and tip of tooth on right camshaft sprocket is **precisely** aligned with mark **X** on timing gear carrier.

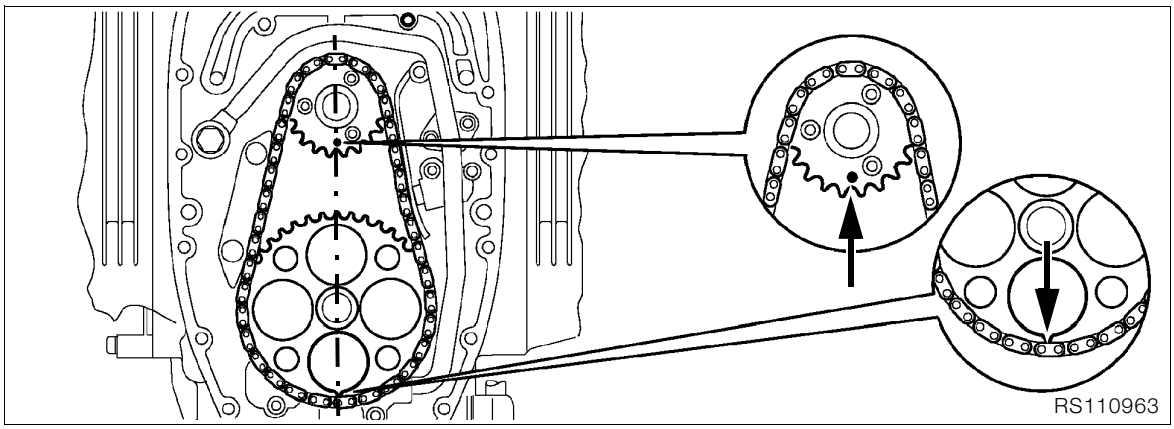
- Check setting again with timing chain tensioner installed.

Installing left cylinder head

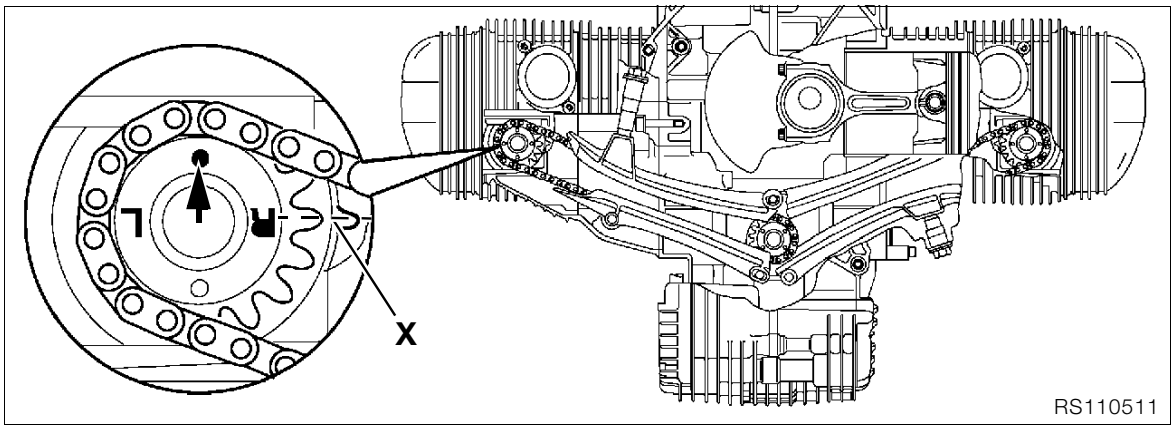
Adjustment specification

Caution:
When installing, **always** begin with the **right** cylinder.





Left cylinder = TDC on ignition stroke: marks (arrows) on chain sprocket/auxiliary shaft and chainwheel/crankshaft face down

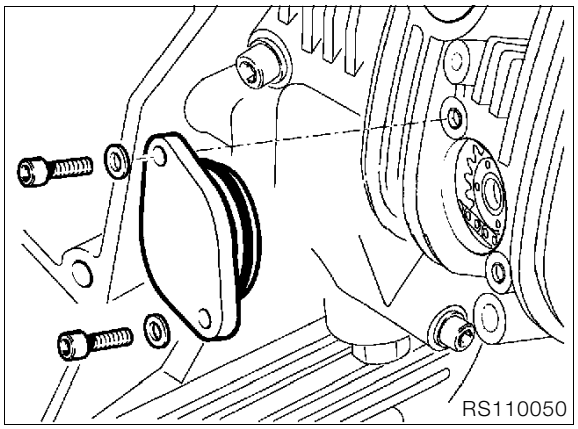


- Locate ignition-stroke TDC with insert pin, **BMW No. 11 2 650**, at hole in clutch housing and engine block.

Note:
With engine installed, adjust to TDC with dial gauge holder, **BMW No. 00 2 650**, and dial gauge, **BMW No. 00 2 510**.

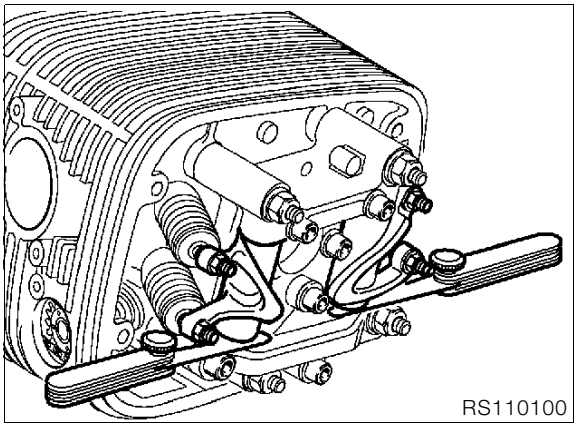
Left cylinder = at TDC on ignition stroke:
Locating pin (arrow) on left camshaft sprocket points upwards.
Mark (**R** or **arrow**) and tip of tooth at left camshaft sprocket is aligned **precisely** with mark **X** on timing gear carrier.

- Check setting again with timing chain tensioner installed.


RS110050

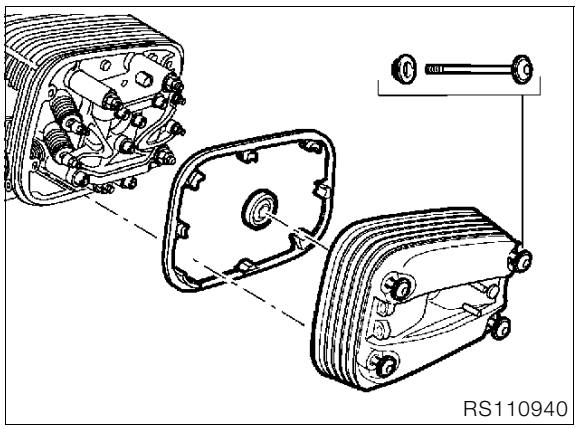
- Install the end cover with an O-ring which is in good condition.

Tightening torque:
M 6 screw ..... 9 Nm


RS110100

- If necessary, reduce end play to a minimum by repositioning the bearings.

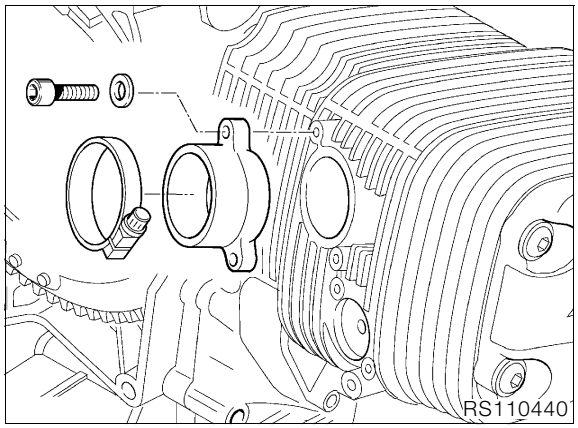
Rocker end float:
min. ..... 0.05 mm (0.002 in)
max. ..... 0.40 mm (0.016 in)


RS110940

- Install cylinder head cover.

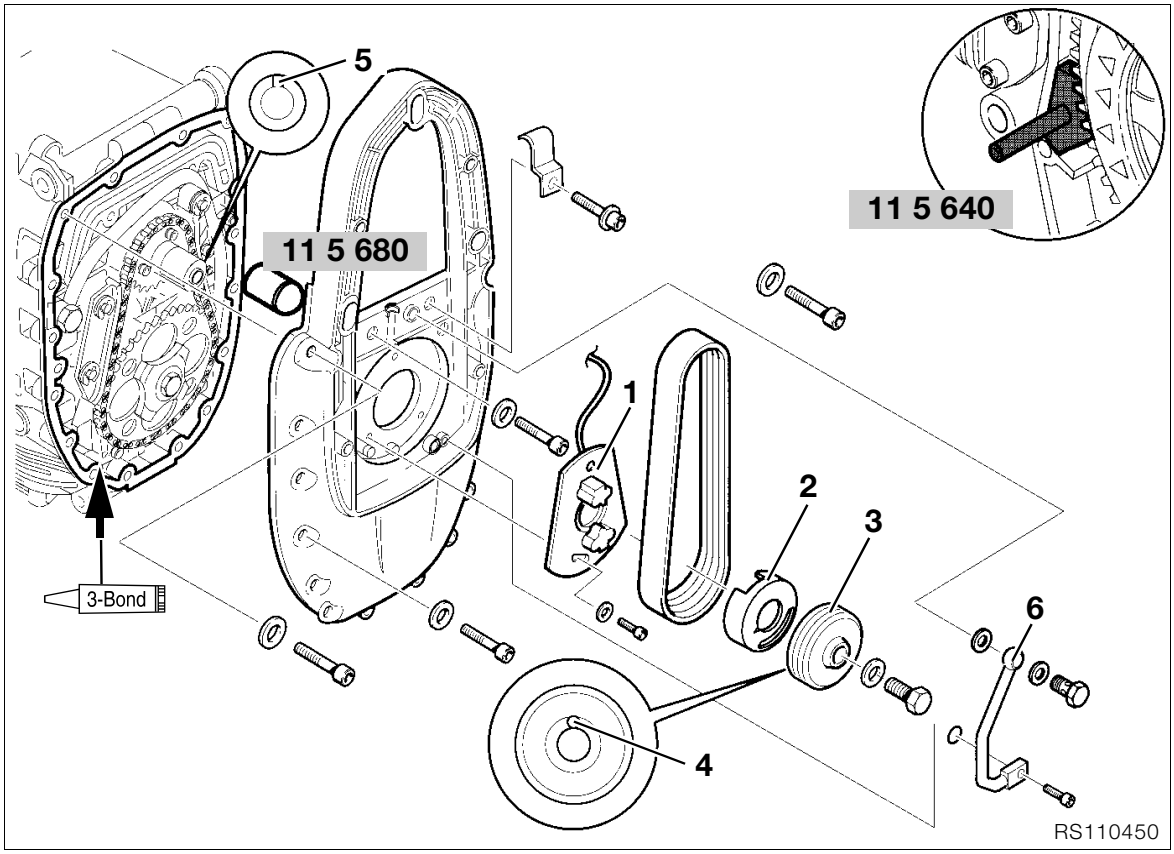
Caution:
Ensure that gaskets are properly seated. Gaskets and sealing face must be free from oil and grease.

Tightening torque:
Cover screw ..... 8 Nm


RS110440

- Tighten air intake stub pipe.

Tightening torque:
M 6 screw ..... 9 Nm



Installing alternator mount cover

- Place sliding sleeve, **BMW No. 11 5 680**, on crankshaft.
- Apply **3-Bond 1209** to the sealing face (arrow), which must be clean and free from grease.
- Install alternator mount cover.

Tightening torque:

M 8 screw ..... 20 Nm
M 6 screw ..... 9 Nm

Installing magnetic gate/belt pulley

- Install Hall-effect trigger plate (1).
- Lock clutch housing with special tool **BMW No. 11 5 640**.
- Secure rotor (2) of Hall-effect gate to the Poly-V belt pulley (3) with, for example, **Loctite instant adhesive.**
- Install the Poly-V belt pulley.

Caution:
Install retainer for Hall-effect gate rotor (4) at groove in crankshaft (5).

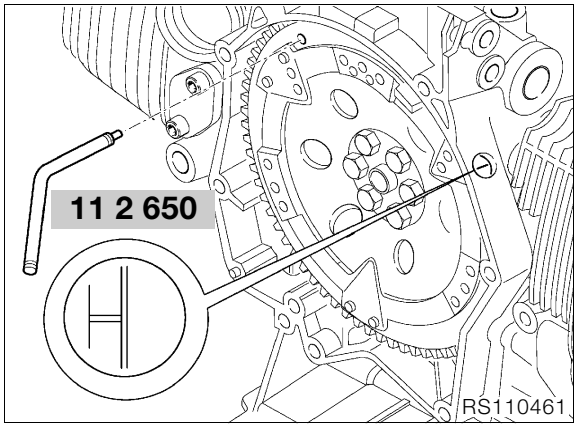
Tightening torque:

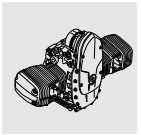
Retaining screw for belt pulley..... 50 Nm

- Install rotary breather pipe (6) with new sealing rings.

Tightening torque:

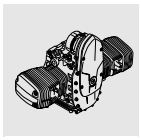
Vent line to alternator mount cover
M 8 screw ..... 20 Nm
Banjo screw ..... 25 Nm

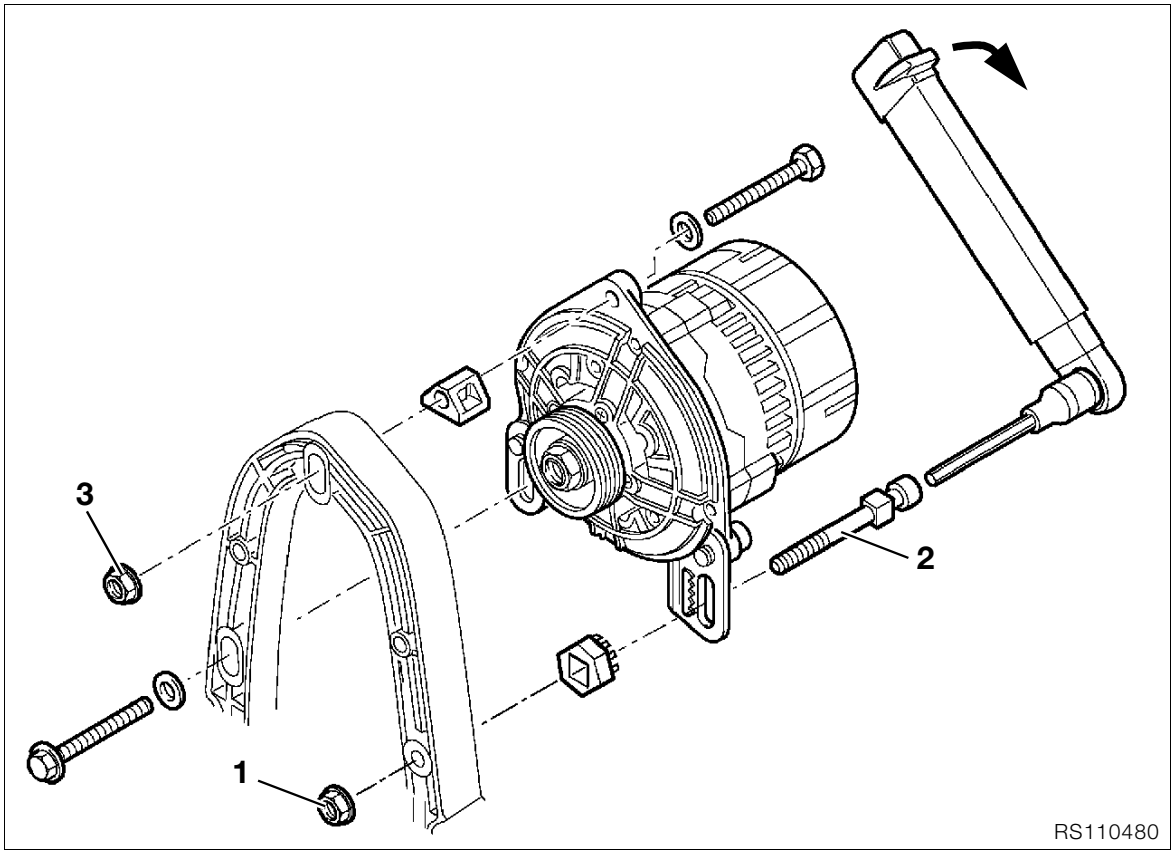




Timing the ignition

- Using TDC locating pin, **BMW No. 11 2 650**, lock the clutch housing.
- Connect **BMW MoDiTeC** with adapter cable to Hall-effect gate plate.
- Adjust in accordance with tester guidance.
- Remove the TDC locating pin.





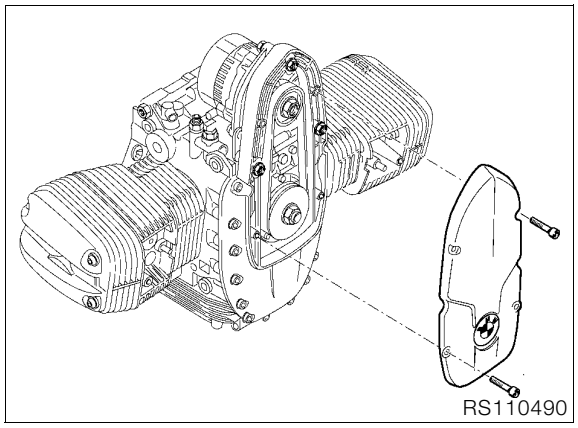
Installing alternator

- Install alternator.

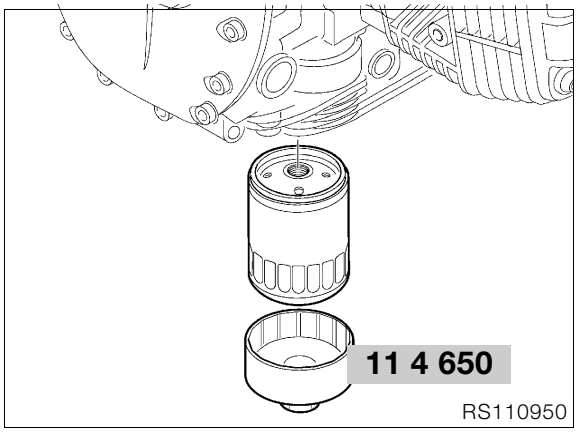
Poly-V belt adjusting procedure:
Poly-V belt installation procedure:

- Screw hex nut (1) on adjusting screw (2) up handtight (**no tools to be used**)
- Tighten adjusting screw (2) with a torque wrench, fully tighten retaining nut (3), slacken adjusting screw and tighten screws fully.

Tightening torque:
Pre-tension Poly-V belt
with adjusting screw..... 8 Nm
Alternator to alternator support cover..... 20 Nm



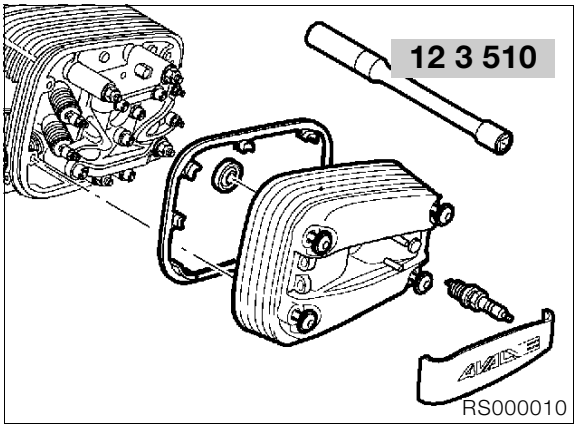
- Install front cover.



- Install oil filter with oil filter wrench, **BMW No. 11 4 650**.
- Insert and tighten oil drain plug with a new seal.

Tightening torque:

Oil filter (sealing face lightly oiled) ..... 11 Nm
Oil drain plug..... 32 Nm



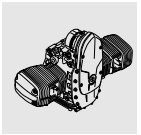
- Install spark plugs with spark plug socket wrench, **BMW No. 12 3 510**.

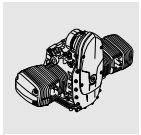
Tightening torque:

Spark plug..... 20 Nm

Installing engine

- Work in reverse order to that stated for removal.





12 Engine electrics

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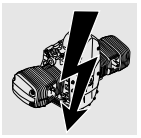
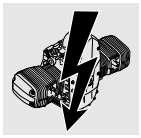
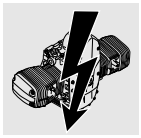
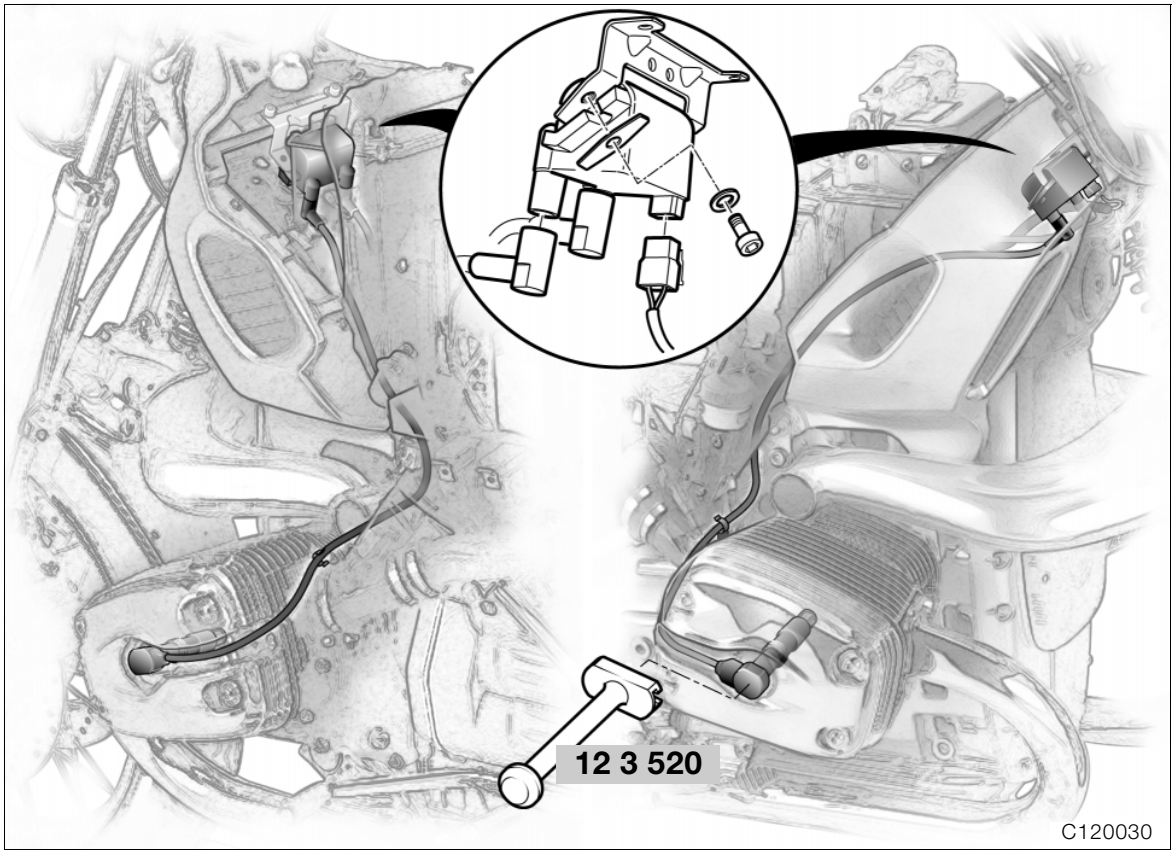




Technical data		R 850 C	R 1200 C
Starter motor			
Type		Permanent-magnet motor with planetary gear drive	
Gear ratios		Planetary gears 5.5 : 1	
Power rating	kW	1.1	
Alternator			
Type		Three-phase alternating-current generator with integrated all-electronic voltage regulator	
Drive		Poly-V belt	
Gear ratios		1 : 1.5	
Maximum output rating	W/V	700/14	
Maximum current at engine speed 4000 min^{-1}	A	50	
Nominal current at engine speed 1000 min^{-1}	A	18	
Max. operating speed	min^{-1}	20 000	
Spark plug			
Bosch		FR 6 DDC	
Electrode gap	mm (in)	0.8 (0.03)	
Wear limit	mm (in)	1.0 (0.04)	
Thread	metric	M 14 x 1.25	
Ignition			
Ignition system		Motronic (mapped characteristic control)	
Ignition trigger		Two magnetic gates (Hall-effect transmitters) driven from crankshaft	
Ignition timing	°CS	0° ... + 43° before OT	
Static ignition timing	°CS	Adjustment at TDC	
Ignition coil			
Twin-spark coil			
Resistance: Primary between terminals 15 and 1	Ω	~0.5	
Secondary between terminals 4a and 4b	kΩ	~7.5	





Removing and installing coil and ignition lead

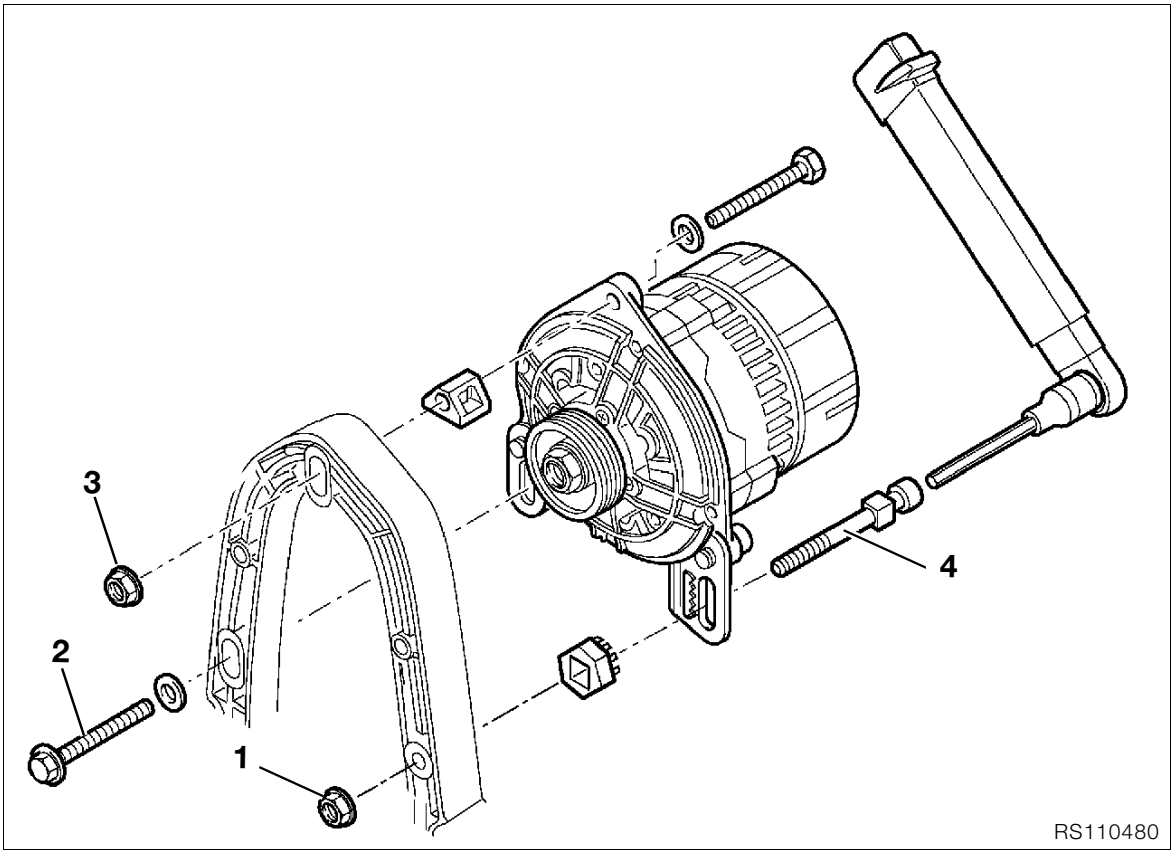
- Remove fuel tank.

⚠ Caution:
Switch off ignition. Disconnect ground (earth) cable at battery and insulate it.

- Pull off spark plug cap with special puller, **BMW No. 12 3 520**.
- Release threaded connection for central electrical equipment box.
- Remove ignition leads.

Check ignition coil resistance

- Test with **BMW MoDiTeC**.



Removing and installing alternator

- Remove seat.
- Remove fuel tank.

Caution:
Switch off ignition. Disconnect ground (earth) cable at battery and insulate it.

- Remove horn with holder.
- Remove front cover from engine.
- Remove alternator retainers (1, 2, 3).
- Remove rotary breather tube.
- Remove Poly-V belt.
- Remove the starter motor.
- Lock clutch housing with special tool **BMW No. 11 5 640**.
- Remove Poly-V belt pulley with rotor gate at crankshaft.
- Remove the left exhaust pipe.
- Drain engine oil.
- Remove the oil cooler return line.
- Pull the rear of the motorcycle down to the hoist platform and secure it with a strap or similar.
- Detach the left air intake flange.

Caution:
Mask off the leading link to prevent it from being scratched.

- Release the threaded connection for the lower suspension strut mount.
- Release the leading link shaft at the right and remove it to the left.
- Pull the leading link forwards.
- Place sliding sleeve, **BMW No. 11 5 680**, on the crankshaft and remove the alternator support cover.
- Detach the central electrical equipment box and raise it as far as possible.
- Detach the connecting leads at the alternator.
- Remove the alternator.
- Install by following the above work instructions in the reverse order.

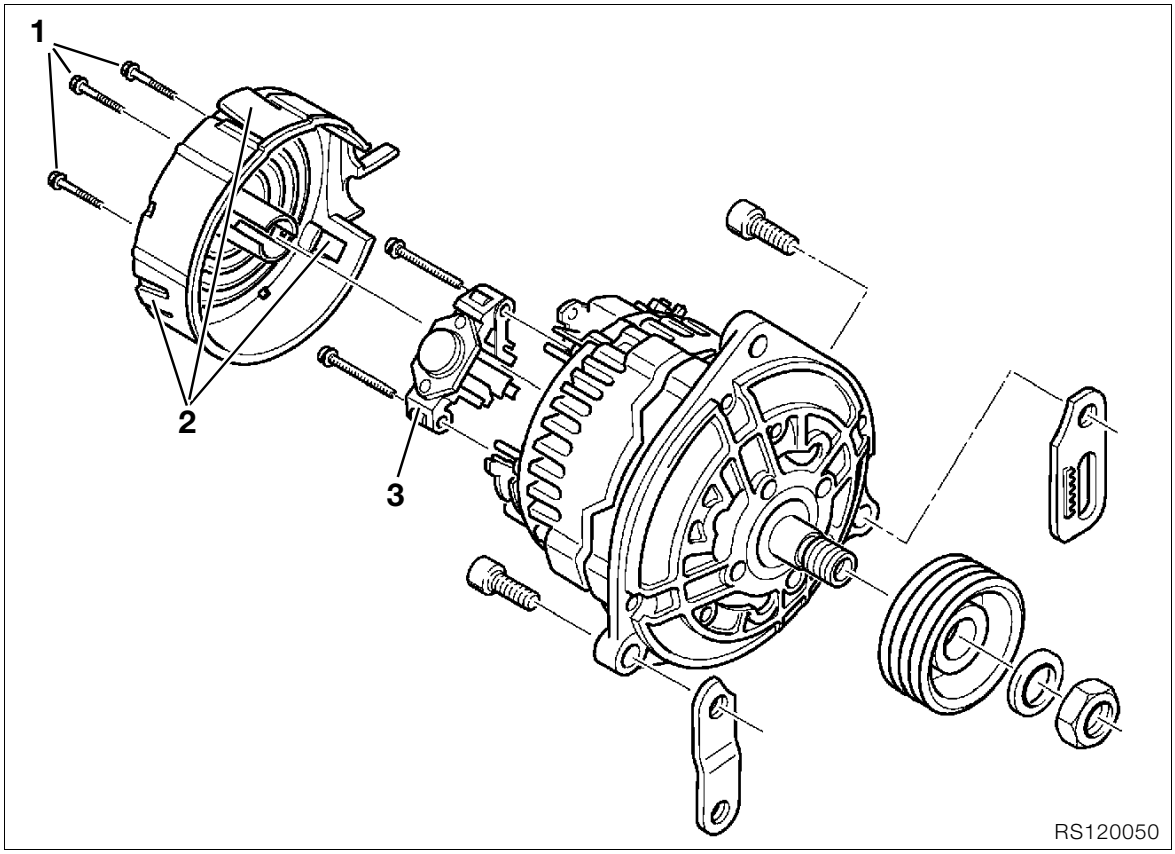
Poly-V belt adjusting procedure:
Poly-V belt installation procedure:
- Place the Poly-V belt in position, tension it and turn the engine over once, then release belt tension.

Poly-V belt tensioning procedure:
- Loosen alternator mount (1, 2, 3).
- Screw up hex nut (1) at adjusting screw (4) lightly by hand (**using no tools**).
- Tighten adjusting screw (4) using torque wrench; fully tighten retaining nut (3), slacken off adjusting screw and tighten down screws.

Note:
See also Service Information 12 020 95 (700).

Tightening torque:

Poly-V belt preload	8 Nm
Alternator to alternator support cover	20 Nm
Positive lead to alternator	15 Nm
Belt pulley at alternator	50 Nm



Dismantling/reassembling alternator

- Take out the cover retaining screws (1).
- Release clips (2) and remove the cover.
- Remove voltage regulator (3).
- Remove the Poly-V belt pulley.
- Install by following the above work instructions in the reverse order.

Tightening torque:

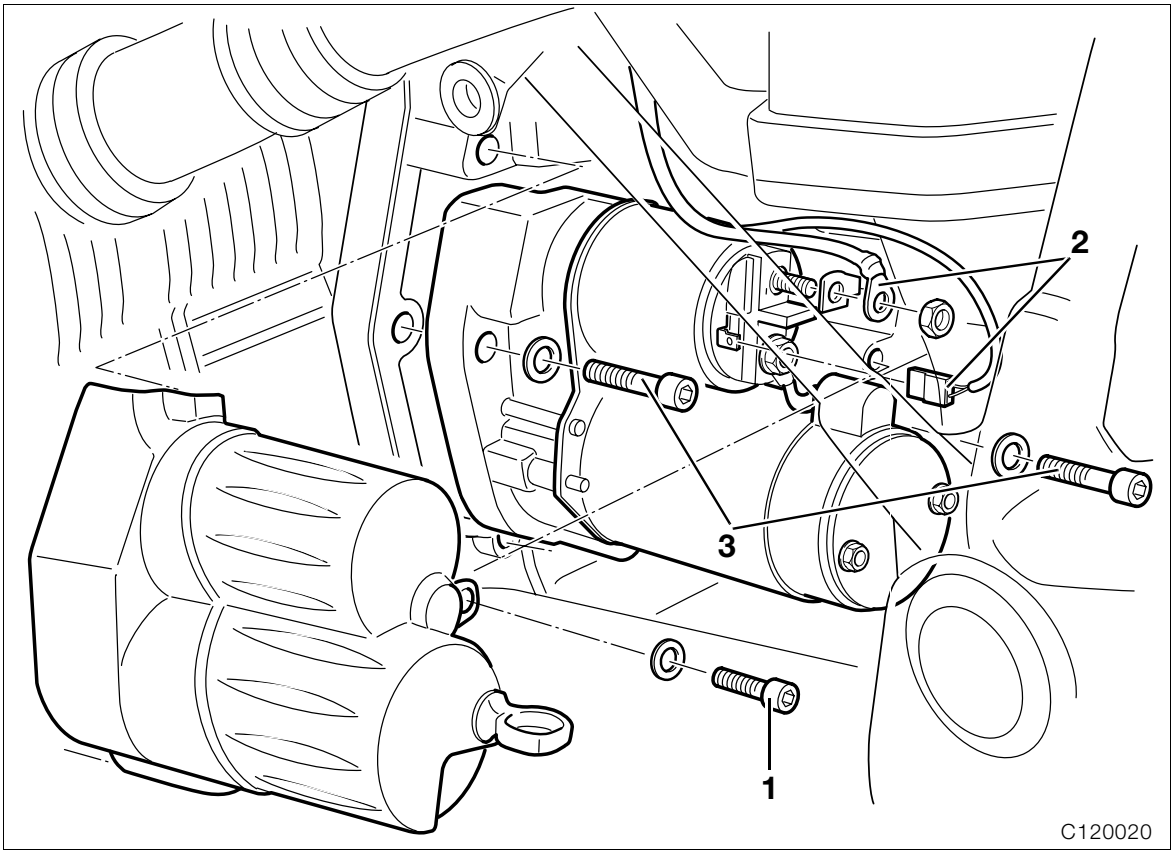
Belt pulley at alternator..... 50 Nm

Checking alternator

- Test with **BMW MoDiTeC**.

Checking armature for short to ground (earth)

- Test with **BMW MoDiTeC**.



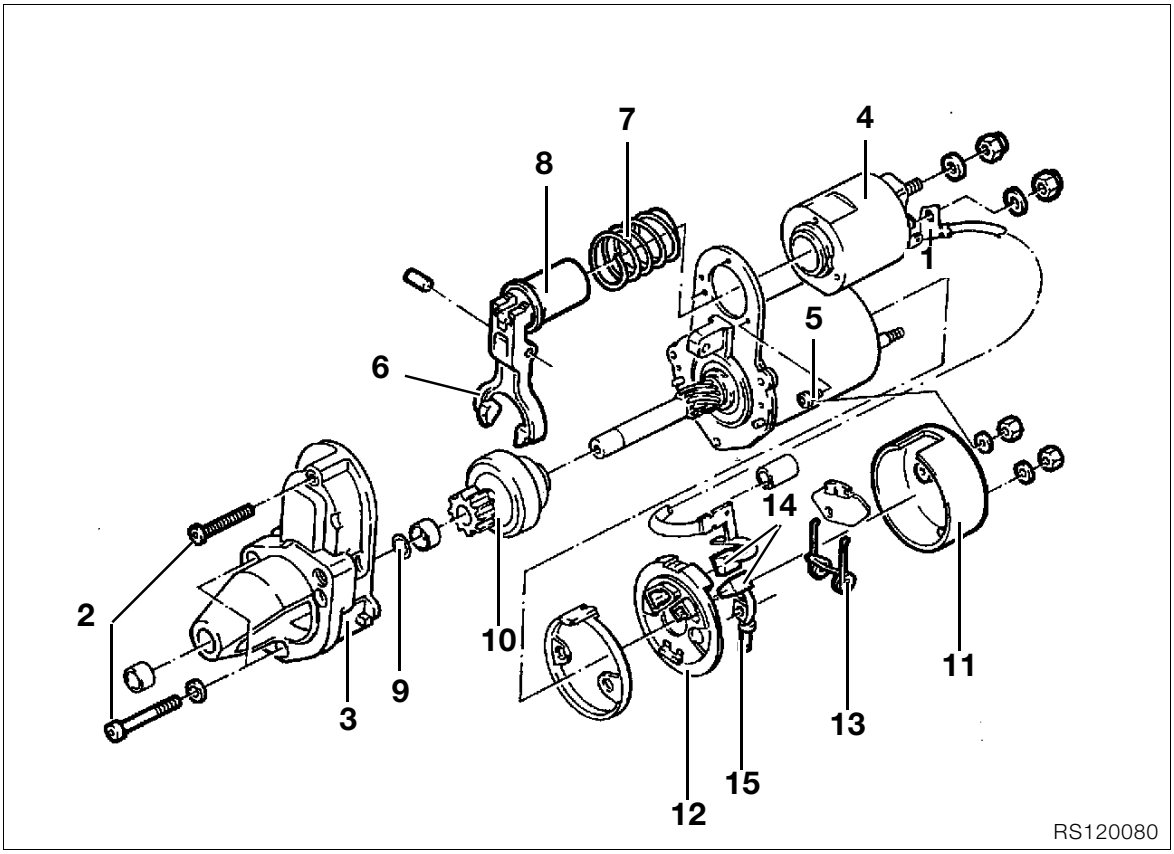
Removing and installing starter motor

Caution:
Disconnect earth (ground) lead from battery.
Insulate earth (ground) lead.

- Release starter motor cover (1).
- Remove the cover.
- Detach lead (2).
- Release starter motor retainer (3).
- Remove the starter motor.
- Install by following the above work instructions in the reverse order.

Tightening torque:

Starter motor to engine ..... 20 Nm
Starter motor cover to gearbox housing ..... 7 Nm
Positive lead to starter motor ..... 10 Nm



Dismantling/reassembling starter motor

- Detach lead (1).
- Remove retaining screws (2).
- Remove flange (3).
- Remove solenoid switch (4) after taking out the retaining screws (5).
- Remove release lever (6) and spring (7) from solenoid switch (8).
- Remove retaining ring (9) and take starter motor gear assembly (10) off shaft.
- Install by following the above work instructions in the reverse order.
- Coat the helical thread and pull-in ring with grease.

Lubricant:..... Bosch PZ 2 V 3 silicone grease or equivalent

Renewing carbon brushes

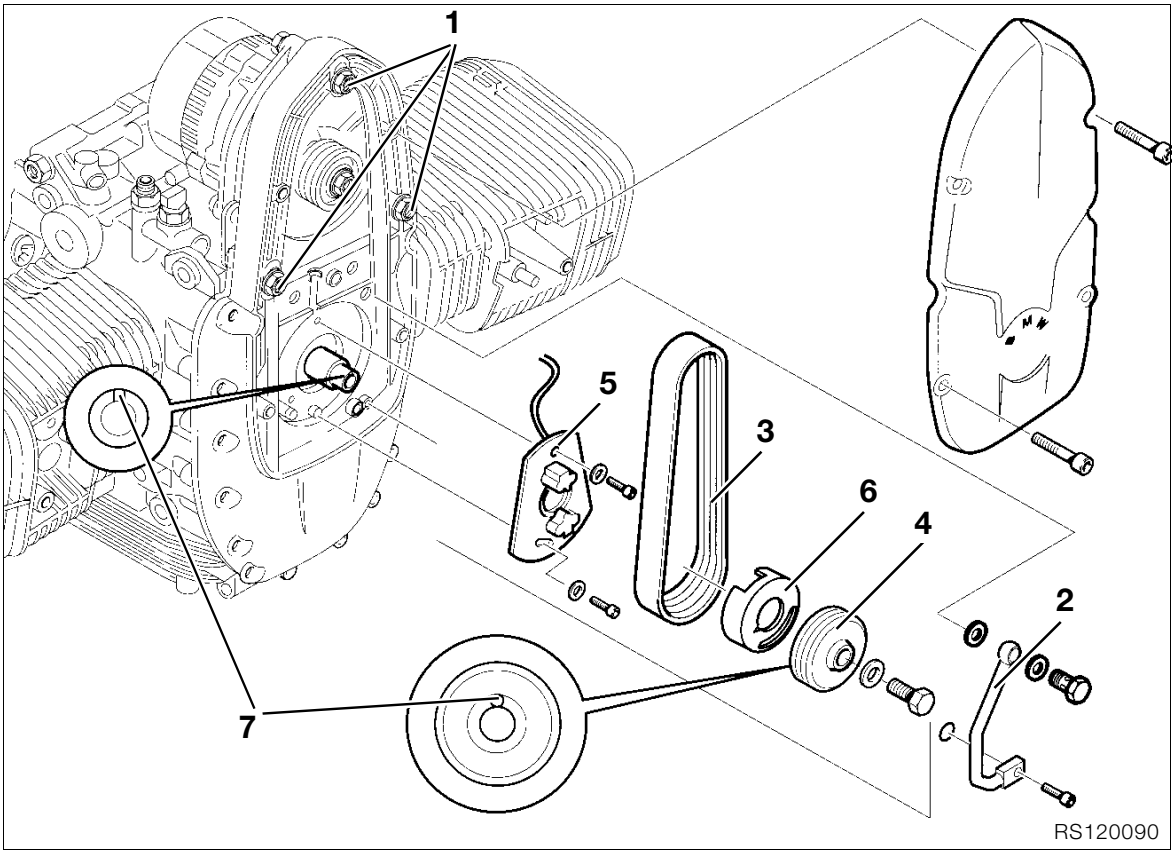
- Detach lead (1).
- Remove cover (11).
- Remove holder (12) for carbon brushes.
- Lift up retaining springs (13) and remove carbon brushes (14).
- Install carbon brushes with retaining plate.
- Slide short lead (15) on to threaded pin.
- Install cover (11).
- Attach lead (1).

Checking starter motor

- Test with **MoDiTeC**.

Checking starter relay

- Test with **MoDiTeC**.



Removing and installing magnetic gate

- Remove seat.
- Unscrew fuel tank mount.
- Pull fuel tank to the rear and support it at the front with a piece of wood or similar.

Caution:
Avoid scratching any components, for instance by inserting a piece of cloth between the fuel tank and the frame.

- Remove the horn with its holder.
- Remove front cover from engine.
- Unscrew alternator mount (1).
- Remove rotary breather tube (2).
- Remove Poly-V belt (3).

Caution:
Disconnect ground (earth) lead from battery. Insulate the ground (earth) lead!

- Remove the starter motor.
- Lock clutch housing with special tool **BMW No. 11 5 640**.
- Remove Poly-V belt pulley (4) with rotor gate at crankshaft.
- Separate the plug connection for the magnetic trigger in the central electrical equipment box.

Note:
If necessary, mark position of magnetic trigger for later installation.

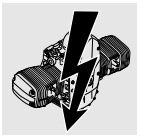
- Remove magnetic trigger (5).
- Install in reverse order of work.
- Attach rotor (6) of Hall-effect gate with adhesive to the Poly-V belt pulley (4).

Adhesive: .....Loctite instant adhesive or equivalent

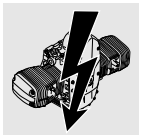
Caution:
Install retainer for Hall-effect rotor at groove/crankshaft (7).
Carefully dismantle magnetic trigger lead. Tension Poly-V belt according to installation procedure.

Tightening torque:
Pre-tension of Poly–V belt ..... 8 Nm
Alternator to alternator mount cover..... 20 Nm
Belt pulley to crankshaft..... 50 Nm

Timing the ignition



- Screw dial gauge holder, **BMW No. 00 2 650**, and dial gauge, **BMW No. 00 2 510**, into right or left spark plug hole.
- Turn the engine over until the piston is at TDC.
- Set the dial gauge pointer to zero.
- Check the dial gauge reading.
- Turn the engine over until the piston is at TDC.
- The dial gauge pointer must be at zero.
- Connect **BMW MoDiTeC** with adapter lead to the Hall-effect gate plate.
- Adjust as stated in the tester guide.



13 Fuel preparation and control

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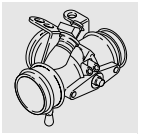
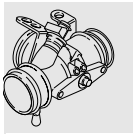
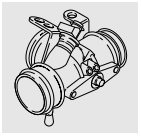
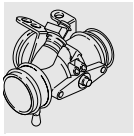
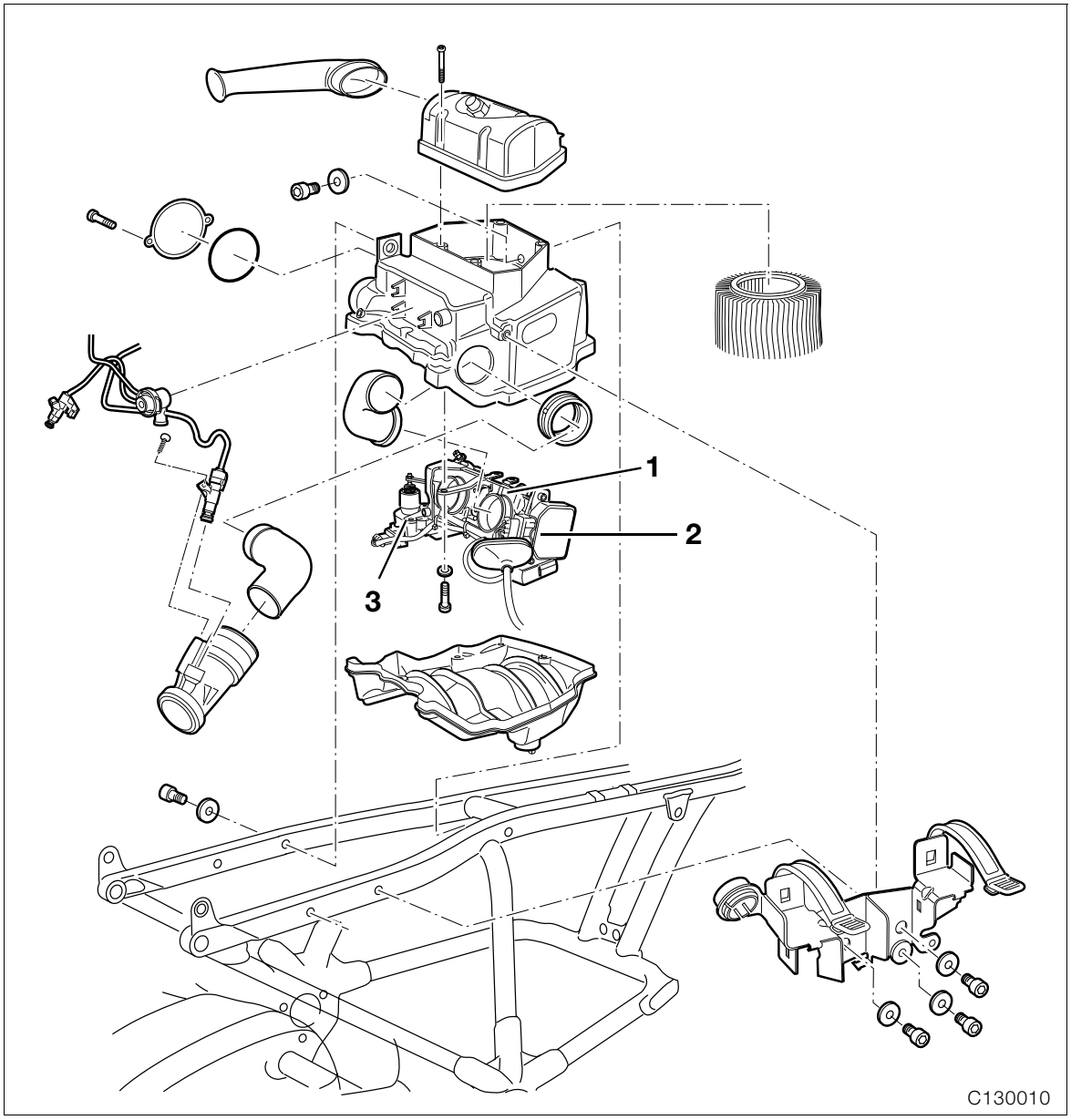


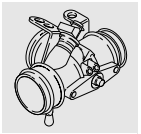


Technical data		R 850 C	R 1200 C
Fuel grade		Super (premium), unleaded, 95 octane (RON)	
Mixture preparation		Motronic MA 2.4	
Throttle stub pipe intl. dia.	mm (in)	35 (1.38)	
Throttle angle in rest position		depending on throttle positioner	
Air cleaner		Flat-pattern paper element	









Removing and installing air cleaner

➟ See Group 46 (Removing/installing rear frame)

Removing and installing throttle stub pipe

- Remove throttle stub pipe (1).

Removing and installing throttle potentiometer

- Remove throttle potentiometer (2).
- Adjusting throttle potentiometer with **BMW MoDiTeC** after installing
- Mark screws with a paint spot.

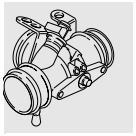
Removing and installing throttle positioner

- Remove the throttle positioner (3).

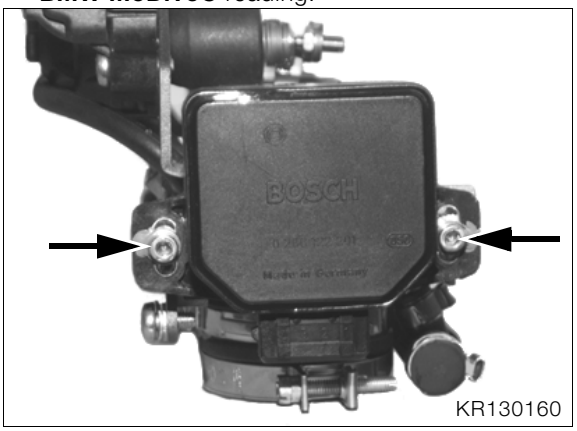
Caution:
The throttle positioner operates at the control unit voltage of 5 V. It must not be connected directly to the motorcycle's electrical system.

Tightening torque:
Throttle positioner retaining screw
(clean thread + Loctite 2701)

Removing and installing throttle potentiometer

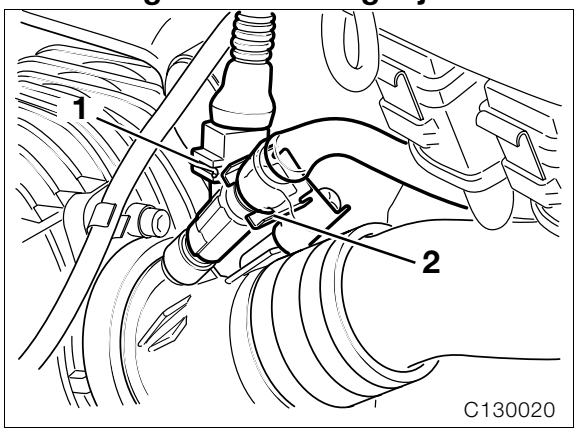


- When a new throttle potentiometer is installed, it must be adjusted in accordance with the **BMW MoDiTeC** reading.



- Mark the retaining screws (arrows) with a paint spot.

Removing and installing injectors



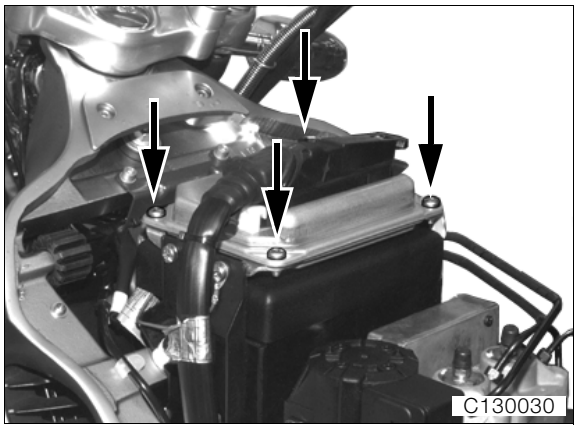
- Press in the spring catch at the injector plug (1) and pull off the plug.
- Unfasten retainer (2) for fuel pipe and pull off the pipe.
- Remove injector.
- Install by following the above work instructions in the reverse order.

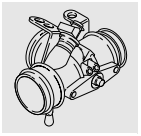
Caution:
The keeper (2) must be inserted from the inside outwards. It then prevents the injector from turning. Make sure that the keeper (2) engages correctly. Make sure that O-rings at the injector are in good condition.

Removing and installing Motronic control unit

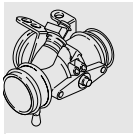
- Remove fuel tank.

⚠ Caution:
Switch off ignition; disconnect earth (ground) lead at battery and insulate it.





- Remove Motronic control unit.
- Remove connector strip.
- Install by following the above work instructions in the reverse order.



16 Fuel tank and lines

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Removing and installing fuel filter 6

Removing and installing fuel pump and fuel level sensor 7

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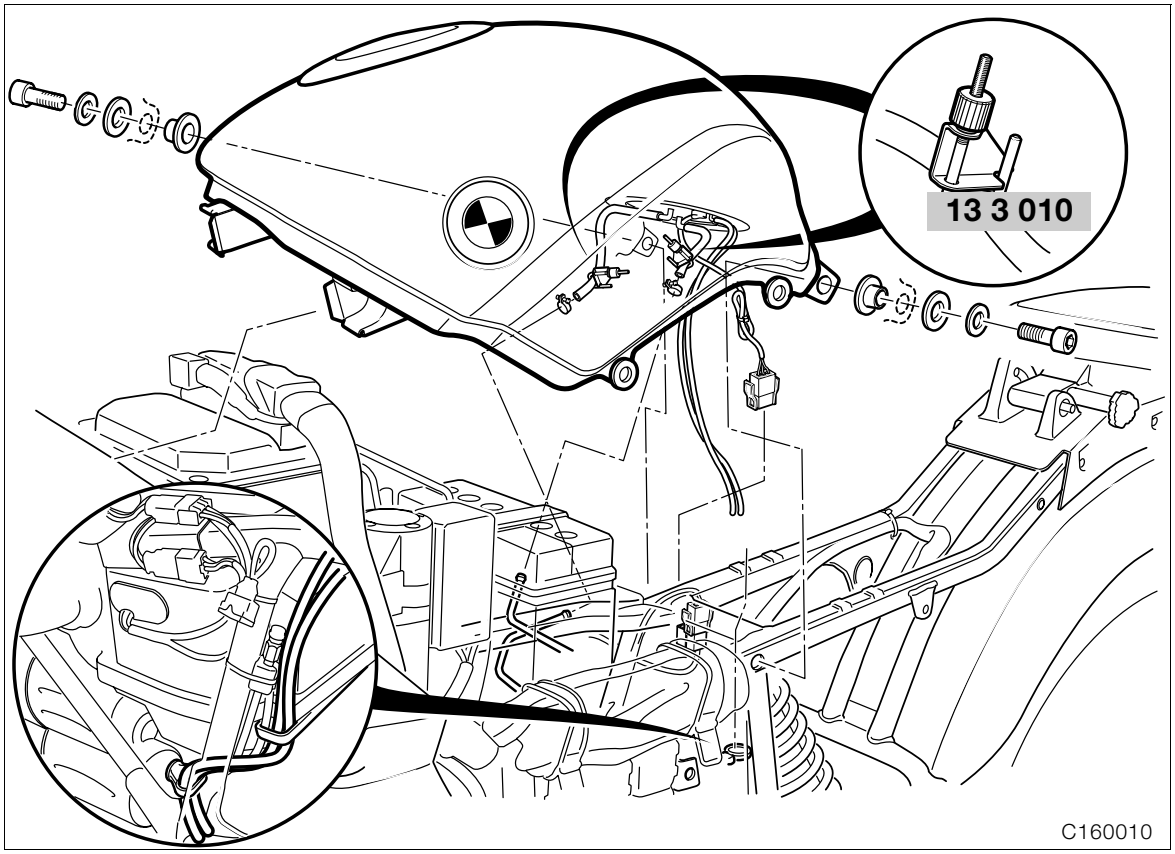
Removing and installing fuel distributor and pressure regulator 7

Technical data		R 850 C	R 1200 C
Fuel tank			
Tank capacity	l (Imp. gal/ US gal)	17 (3.74/4.50)	
including reserve of	l (Imp. gal/ US gal)	4 (0.88/1.06)	
Fuel pump			
Type		Gear-type	
Make		VDO	
Operating voltage	V	12	
Fuel pressure	bar (psi)	3±0.2 (42.69±2.85)	
Delivery volume	l/h (Imp.gal/h, US gal/h)	110 (24.21, 29.06)	

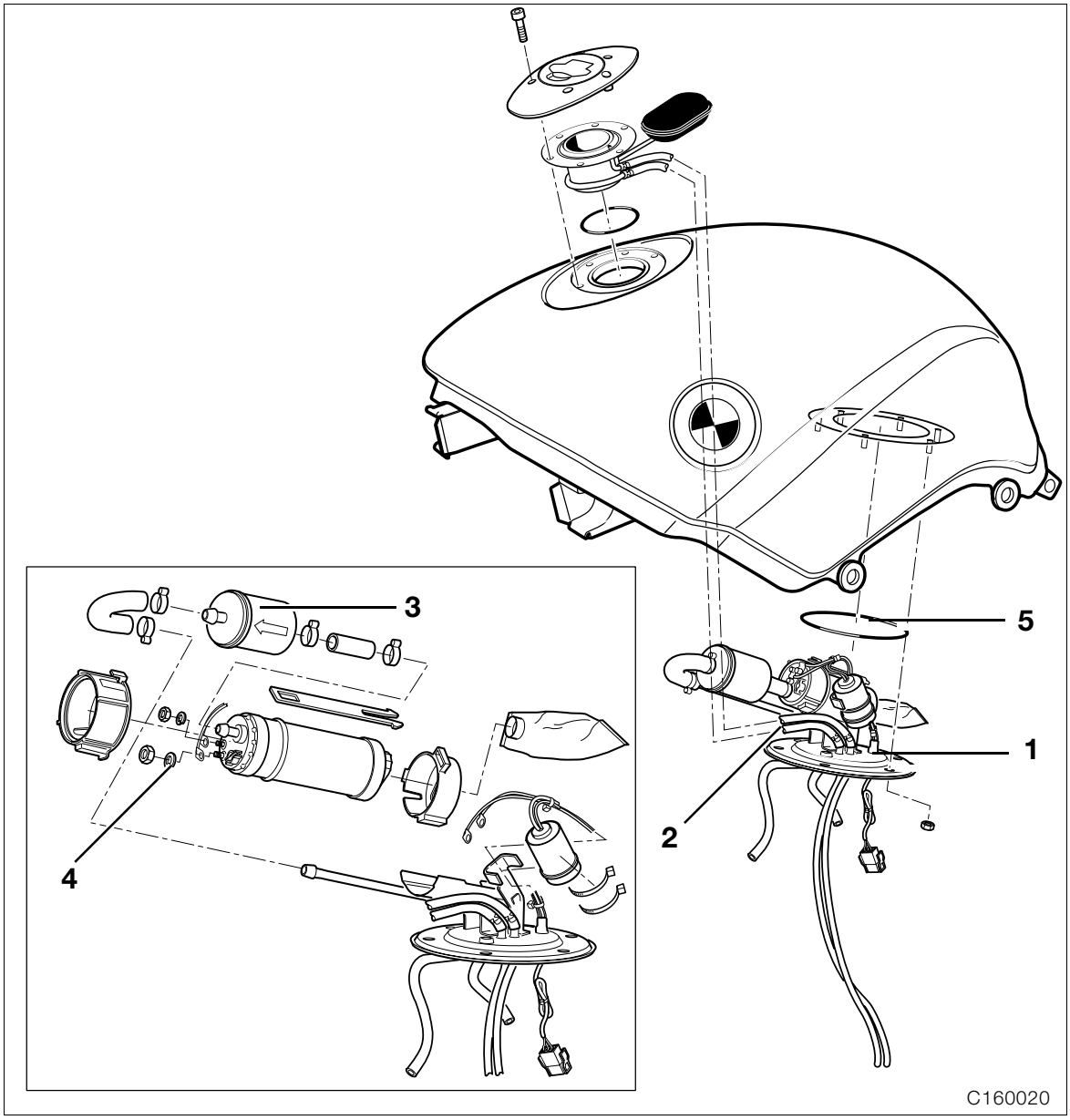


Removing and installing fuel tank

- Seal the fuel feed and return lines with a hose clip, **BMW No. 13 3 010**, detach and pull off.

Tightening torque:

Fuel tank to rear frame ..... 22 Nm



Removing and installing fuel filter, fuel pump and fuel level sensor

Caution:
Fuel is flammable and a hazard to health.
Observe relevant safety regulations.

- Drain fuel tank.
- Remove fuel pump unit (1) and detach hoses (2).

Removing and installing fuel filter

- Release hose clips at fuel filter (3).

Caution:
Note direction of fuel flow at filter.

- Secure non-reusable hose clips with pliers, **BMW No. 13 1 500**.

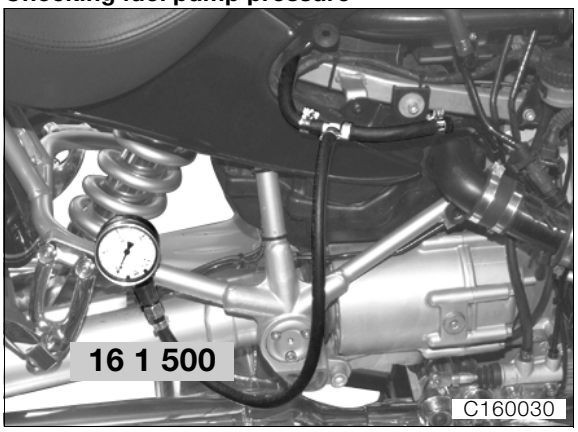
Removing and installing fuel pump and fuel level sensor

- Detach the electrical connections at the fuel pump (4).
- Release the hose clip at the fuel pump.
- Remove fuel pump.
- Install by following the above work instructions in the reverse order.
- Secure non-reusable hose clips with pliers, **BMW No. 13 1 500**.

Caution:
Use only an O-ring (5) in good condition.
After installing, check fuel pump assembly for leaks.

Tightening torque:
Fuel pump assembly to tank..... 6 Nm

Checking fuel pump pressure



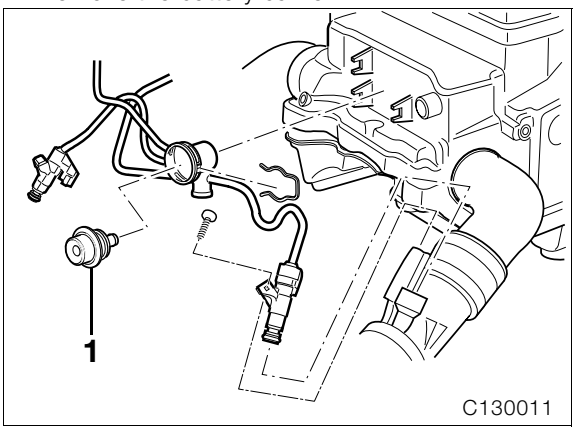
- Connect test pressure gauge, **BMW No. 16 1 500**, at the pressure side.
- Run engine at idle speed.

Fuel pressure:
Desired value ..... 3±0.2 bar (42.69±2.85 psi)

Note:
If fuel pressure is low, check pump, fuel filter, pressure regulator and fuel line.

Removing and installing fuel distributor and pressure regulator

- Remove fuel tank.
- Remove the battery.
- **[ABS]** Remove the ABS unit.
- Remove the battery carrier.



- Remove the fuel distributor with pressure regulator (1) from the holder.
- Install by following the above work instructions in the reverse order.
- **[ABS]** Bleed the brake system.

18 Exhaust system

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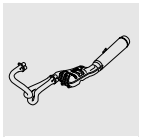
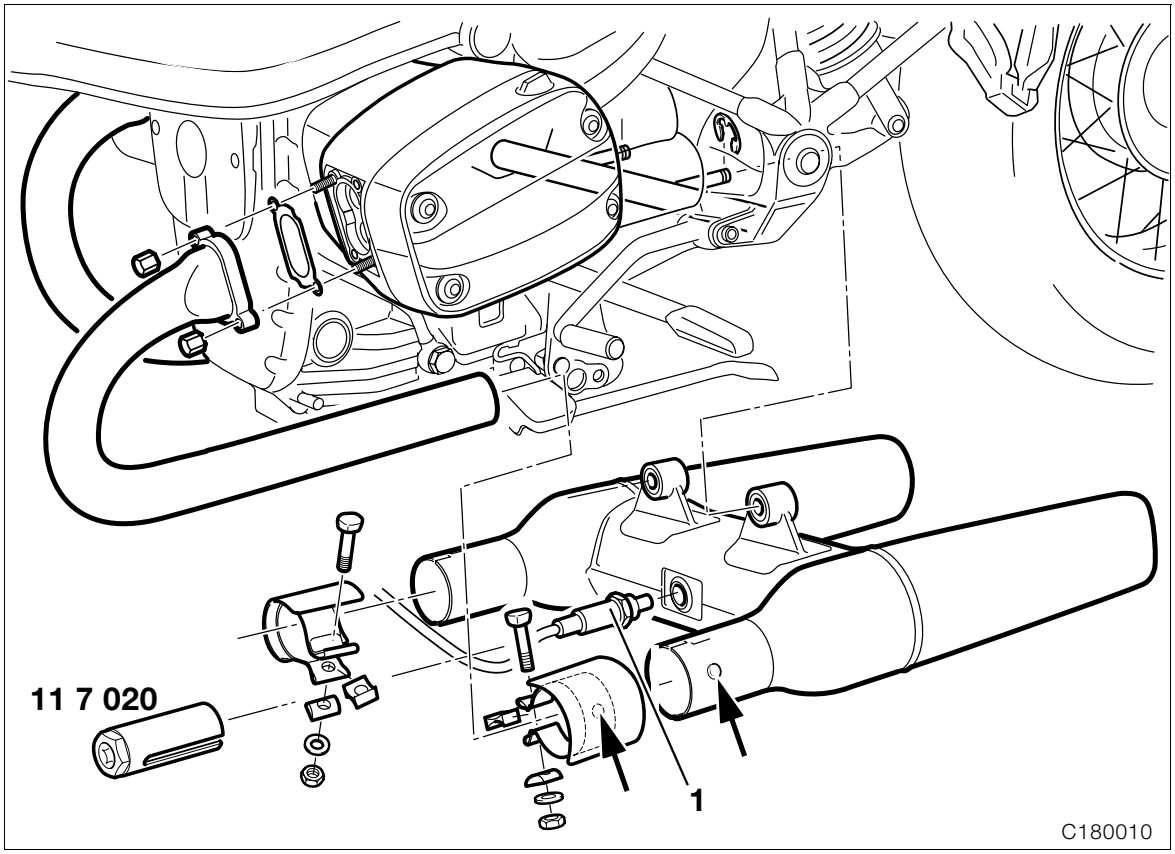
Removing and installing silencer (muffler) 3

Removing and installing front exhaust pipes 3





Removing and installing exhaust system

Removing and installing silencer (muffler)

- Unscrew fuel tank and pull to the rear.
- Separate the plug connection for the oxygen sensor and detach the wire.

Caution:
Do not pull the oxygen sensor cable.

- Loosen the retaining clips.
- Pull off the silencer (muffler).
- Install by following the above work instructions in the reverse order.
- When installing, align the hole (arrow) on the clip with the embossed dot (arrow) on the silencer (muffler).

Caution:
Note position of wiring for oxygen sensor.

Tightening torque:
Clip at silencer (muffler)
(apply Never Seez to the clip contact face)... 55 Nm

- Remove/install the oxygen sensor (1).
- Secure the oxygen sensor with special socket wrench insert, **BMW No.11 7 020**.

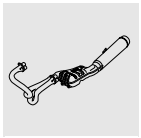
Caution:
After a trial run, read out Motronic fault memory.

Tightening torque:
Oxygen sensor
(coat thread with Never Seez)..... 45 Nm

Removing and installing front exhaust pipes

- When installing, align the hole (arrow) in the clip with the embossed dot (arrow) on the silencer (muffler).

Tightening torque:
Exhaust manifold to cylinder head..... 24 Nm
Clip at silencer (muffler)
(coat clip contact face with Never Seez)..... 55 Nm



21 Clutch

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Removing clutch 5

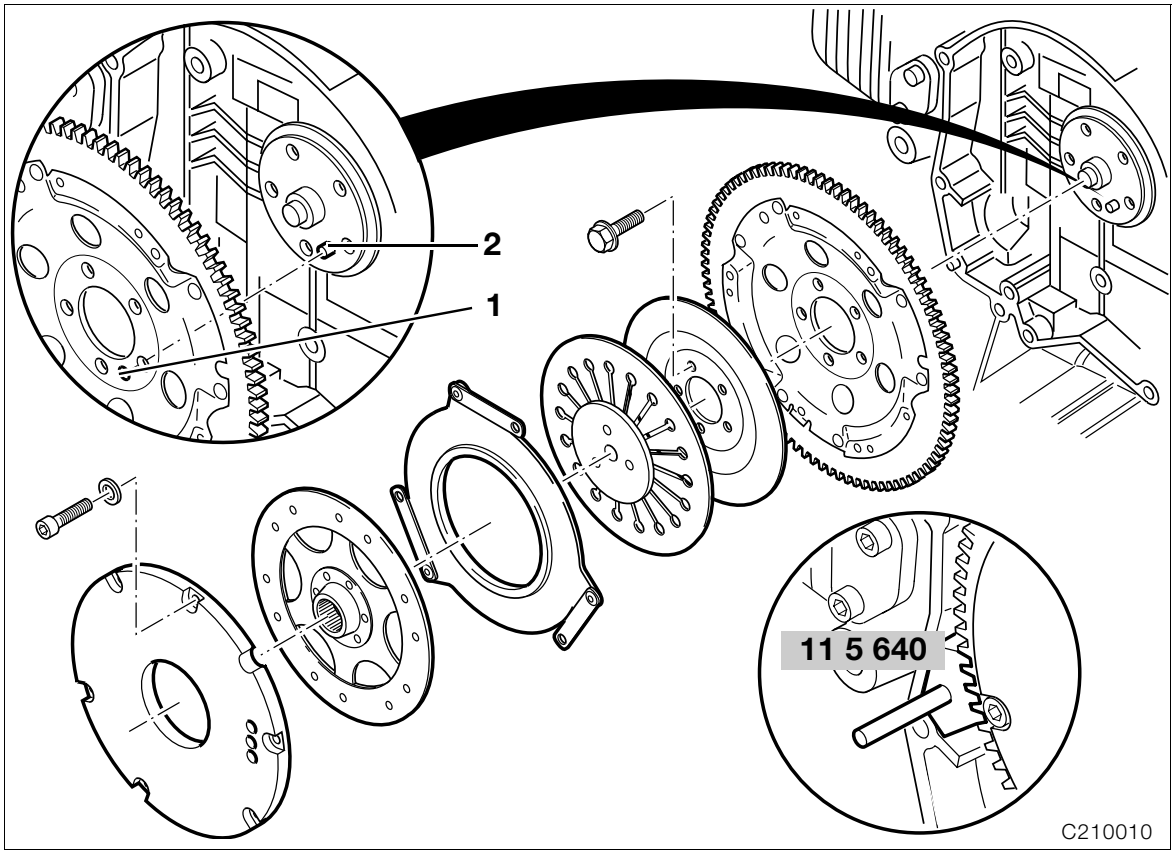
Installing clutch 5

Removing and installing clutch hydraulic line 6

Removing and installing clutch slave cylinder 6

Filling/bleeding clutch line 7

Technical data		R 850 C	R 1200 C
Type of clutch		single dry plate with increased-leverage diaphragm spring	
Operation		hydraulic, with master and slave cylinders	
Master cylinder piston Ø	mm (in)	13 (0.51)	
Slave cylinder piston Ø	mm (in)	24 (0.94)	
Clutch fluid		DOT 4 brake fluid	
Clutch plate dia.	mm (in)	165 (6.50)	
Wear dimension	mm (in)	4.6 (0.18) (measured on rivets of clutch plate using tips of sliding caliper, pressed together by hand)	



Removing and installing clutch

Removing clutch

➟ Preparatory work is as for “Removing gearbox” (see Group 23)

- Lock the clutch housing with special tool **BMW No. 11 5 640**.
- Remove the clutch.

Installing clutch

- Install clutch housing with mark (1) aligned with crankshaft mark (2).
- Lock the clutch housing with special tool **BMW No. 11 5 640**.

Caution:
Always use new bolts for housing and cover.

- Insert all screws by hand and tighten down.

Tightening torque:
Clutch housing to crankshaft
(oil screw threads lightly)
Initial tightening ..... 40 Nm
Wrench angle ..... 32°

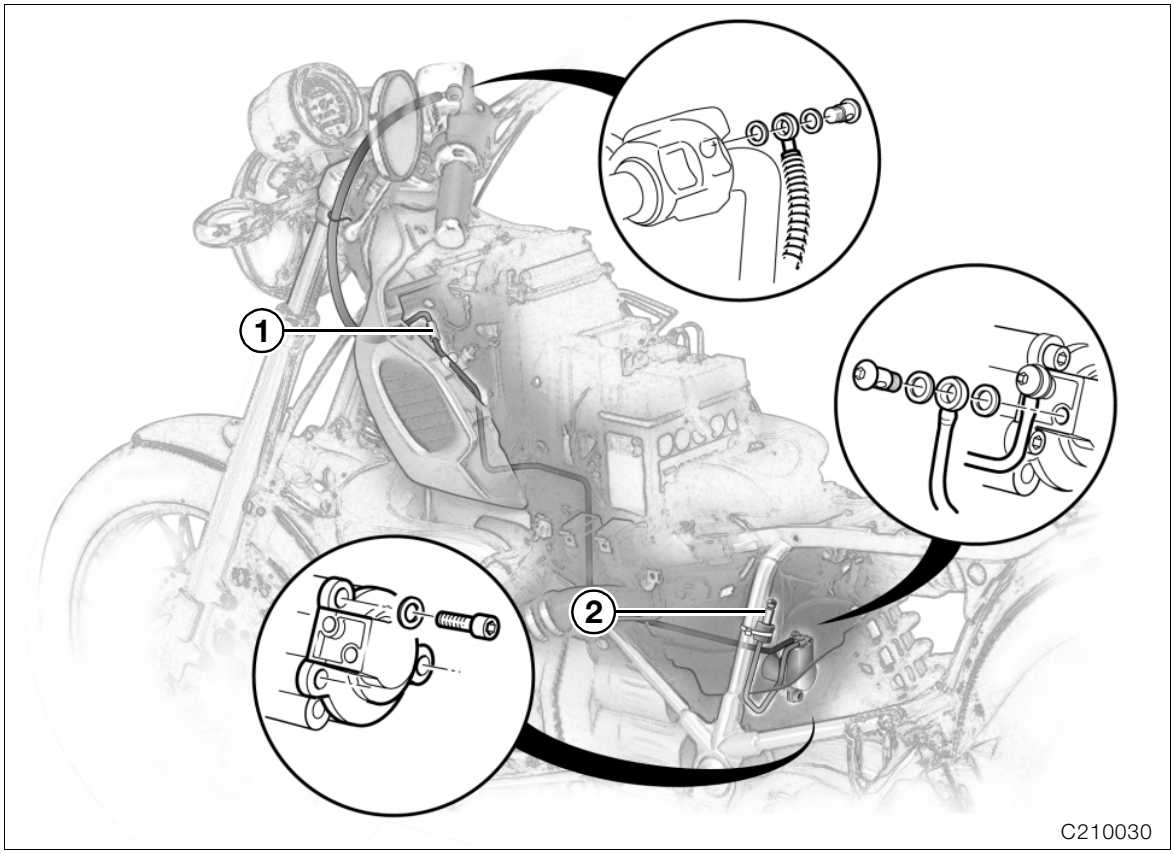
- Install clutch.

Caution:
Offset the color marks on the clutch housing, driven plate and housing cover through 120° in each case.

- Secure the clutch with the retaining screws.
- Center the clutch plate with centering pin, **BMW No. 21 2 673**.
- Tighten retaining screws alternately in a crosswise pattern.

Lubrication points:
Splines on clutch plate and gearbox input shaft.
Diaphragm spring contact surface on clutch housing.
Diaphragm spring contact surface on pressure plate.
..... Optimoly MP3 paste

Tightening torque:
Housing cover to flywheel ..... 12 Nm



Removing and installing clutch hydraulic line

- Remove fuel tank.
- Remove the battery.
- **[ABS]** Drain the brake system.

Caution:
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

- **[ABS]** Remove the ABS unit.
- Remove battery carrier.
- Drain the clutch operating system.

Caution:
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

- Detach the clutch line at the separating point (1).
- Detach the clutch slave cylinder and pull it to the rear with the line.
- Detach the lines at the clutch slave cylinder.
- Install by following the above work instructions in the reverse order.
- Fill the clutch operating system.
- [ABS] Add fluid to brake system.

Note:
When installing, fit new sealing rings.

Tightening torque:
Clutch line to handlebar fitting ..... 18 Nm

Removing and installing clutch slave cylinder

- Remove fuel tank.

Caution:
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

- Detach clutch line at separating point (1).
- Detach and raise the central electrical equipment box at the left.
- Detach the clutch slave cylinder and pull it to the rear with the line.
- Detach lines at clutch slave cylinder.
- Remove clutch slave cylinder.
- Install by following the above work instructions in the reverse order.
- Fill the clutch operating system.

Note:
When instaling, fit new sealing rings.

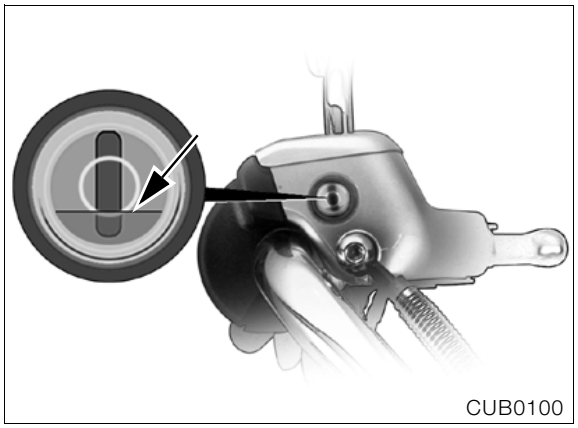
Tightening torque:
Clutch slave cylinder to gearbox ..... 9 Nm

Filling/bleeding clutch line

Caution:
Do not allow brake fluid to come into contact with painted parts of the motorcycle, because brake fluid destroys paint.

Note:
The description applies to a brake system filling and bleeding device with vacuum extraction of brake fluid at the bleed line.
If other devices are used, comply with their manufacturers' instructions.

- Take off reservoir cover with rubber diaphragm.
- **[**Standard handlebar/Police**]** Raise motorcycle on auxiliary stand, **BMW No. 00 1 560**, and swing handlebar fully to right.
- **[**Optional handlebar/Easy Rider**]** Prop motorcycle on side stand and turn handlebar fully to right.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Caution:
With the clutch lining in new condition the surface of the fluid (arrow) must be up to the lower edge of the ring mark; it must **not be below** normal.

Note:
As the clutch lining wears, the fluid level in the reservoir rises.

- Top up the brake fluid.
- Bleed the clutch line through bleed screw (2).

Caution:
During the bleeding operation the brake fluid must not drop below the MIN mark or else air will be drawn into the clutch operating system. If this occurs, repeat the bleeding operation.

- Continue to draw off/pump through the brake fluid until it is clear and free from bubbles.
- Close the bleed screw.
- Correct the fluid level.
- Replace the reservoir lid with rubber diaphragm in position.
- Tighten the reservoir cover without using force.

Operating materials
Brake fluid.....DOT 4

23 Gearbox

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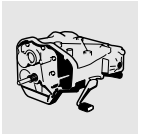
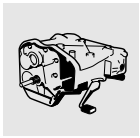
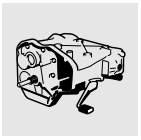
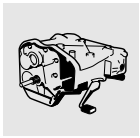


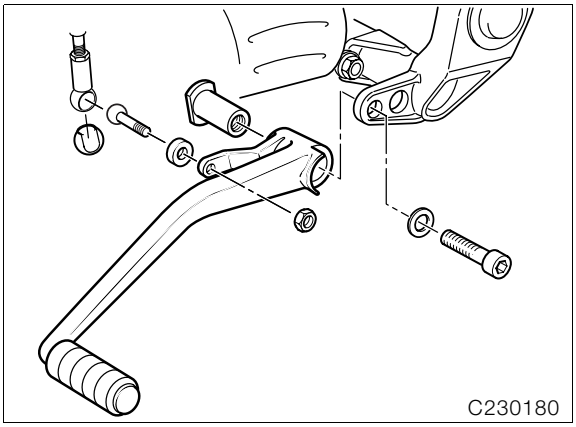


Technical data		R 850 C	R 1200 C
Type of gearbox		5-speed gearbox with claw-action shift and integral reaction damper for all gears	
Gear shift type		Pedal-operated lever and selector drum with overshoot detent	
Gear ratios			
1st gear		3.864	
2nd gear		3.022	
3rd gear		2.393	
4th gear		1.962	
5th gear		1.511	
Oil grade (all the year round)		Brand-name SAE 90 hypoid gear oil, API Class GL 5	
Filling capacity		Initial filling	
	l (Imp. pint/ US quart	1.0 (1.76/1.06) (up to the lower edge of the filler hole)	
		During oil changes	
	l (Imp. pint/ US quart	approx. 0.8 +0.2 (1.41 +0.35/0.85 +0.21) (up to the lower edge of the filler hole)	
Endplay of spring segment at input shaft	mm (in)	0.4...0.6 (0.0157...0.0236)	
Endplay at 1st gear, output shaft	mm (in)	0.1...0.33 (0.0039...0.0130)	
Endplay at 2nd gear, output shaft	mm (in)	0.1...0.33 (0.0039...0.0130)	
Endplay, 3rd/4th gear (total play), output shaft	mm (in)	0.1...0.67 (0.0039...0.0264)	
Selector shaft endplay	mm (in)	0.1...0.3 (0.0039...0.0118)	
Length of intermediate shaft, fully compressed	mm (in)	198.95...199.00 (7.833...7.835)	
Length of output shaft, fully compressed	mm (in)	192.95...193.00 (7.597...7.599)	
Length of input shaft, fully compressed	mm (in)	138.55...138.60 (5.455...5.457)	
Length of selector drum, fully compressed	mm (in)	111.80...111.90 (4.402...4.406)	





Removing and installing gear pedal



Tightening torque:
Gear pedal to frame ..... 41 Nm

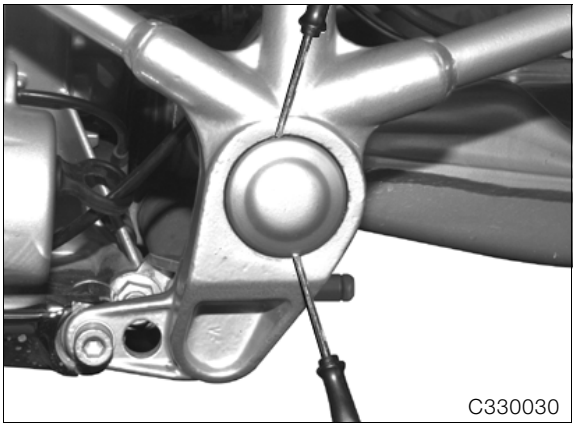
Removing gearbox

Caution:
Switch off ignition.
Disconnect earth (ground) lead from battery.
Insulate earth (ground) lead.

- Attach stand, **BMW No. 00 1 520**, to motorcycle.
- Remove seat.
- Remove side trim.
- Remove fuel tank.
- Remove rear wheel.
- Detach rear brake caliper.
- Detach ABS sensor.
- Detach speedometer signal sensor.
- Detach wire protection at swinging arm.
- Tie up swinging arm with a suitable strap.
- Remove suspension strut.

Note:
Press to rear at top.

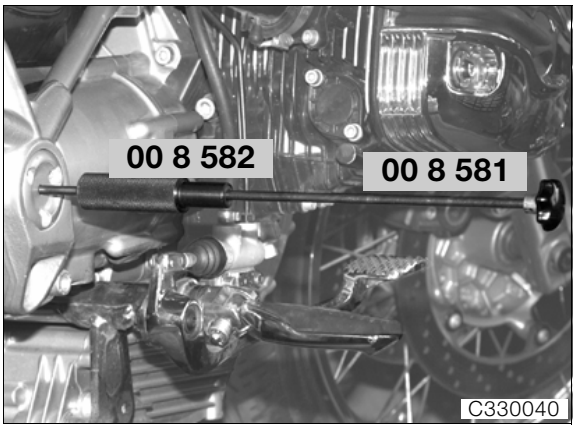
- Pull swinging arm upwards with strap.
- Removing exhaust manifold.
- Remove silencer (muffler).
- Detach plug at oxygen sensor.
- Remove rear wheel drive unit.
- Detach brake hose holder.



- Press off left swinging arm bearing cap.

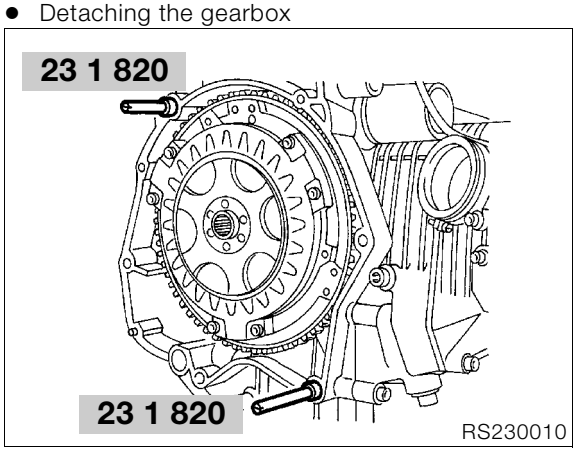
Caution:
When installing again, make sure that the O-ring is in good condition.
The opening must face down so that water can drain out.

- Loosen the left swinging arm.
- Take out the screws at the right swinging arm bearing.

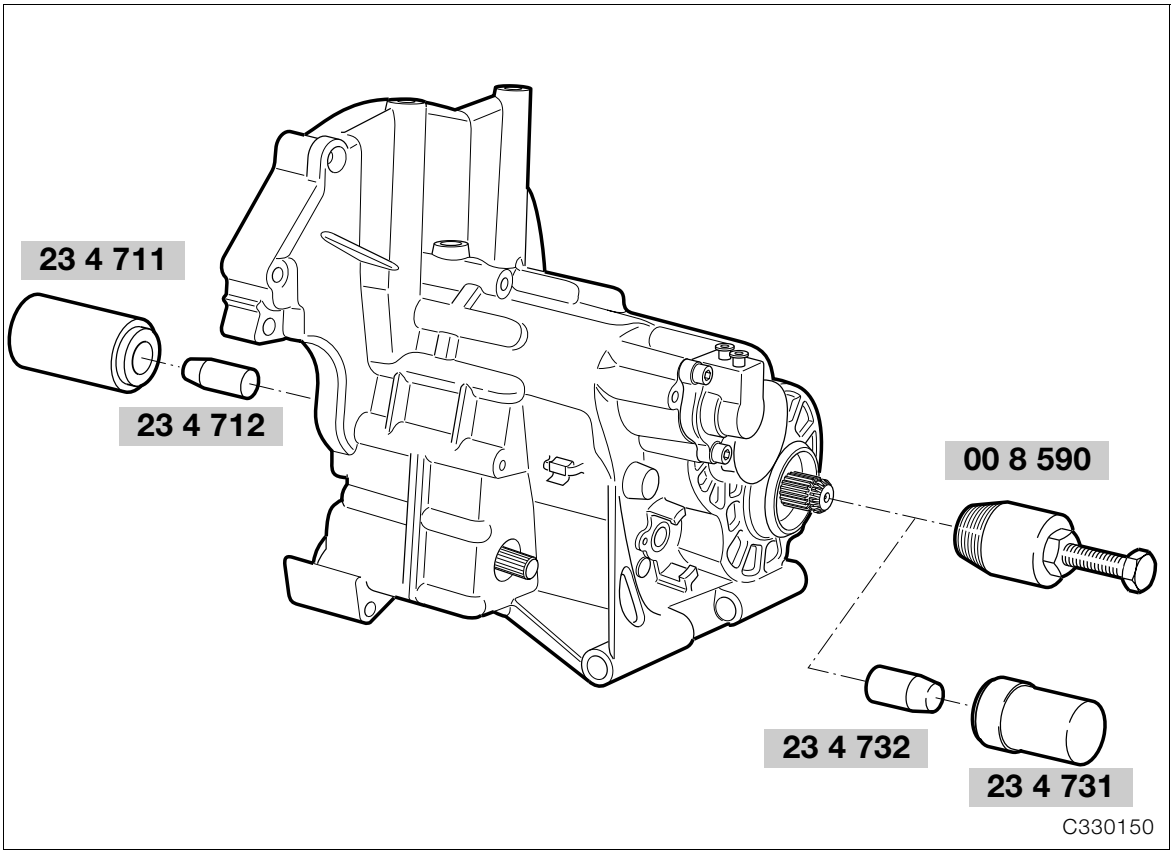


- Using pull rod, **BMW No. 00 8 581**, and impact weight, **BMW No. 00 8 582**, pull out the swinging arm bearing.
- Remove the left swinging arm bearing.
- Remove rear swinging fork.
- Remove the rubber intake pipe sleeves.
- Remove brake fluid reservoir from holder.
- Remove the holder.
- Detach the right plug holder plate.
- Pull off the NTC air plug.
- Detach the gear pedal at the pivot.
- Separate the throttle potentiometer and throttle angle positioner plugs at the left plug holder plate.
- Disconnect both fuse boxes at the plug holder plate.

- Separate the side (prop) stand swithc plug.
- Separate the neutral indicator plug.
- Detach the left plug holder plate.
- Remove the injectors.
- Pull the plugs off the injector lines.
- Disconnect the brake light switch plug and detach the cable.
- Detach the breather hose at the air cleaner casing.
- Detach the throttle cable at the twistgrip.
- Remove rear section of frame.
- Detach the footrest assembly.
- Remove the starter motor cover.
- Detach the positive lead from the starter motor.
- Remove the battery.
- Unscrew rear battery mount.
- Raise the battery holder at the rubber mount.
- Detach the clutch slave cylinder mount and pull out of the gearbox.
- Pull out the thrust rod.
- Detaching the gearbox



- When removing, pull the gearbox out on guide pins, **BMW No. 23 1 820**.
- Install by following the above work instructions in the reverse order.



Renewing the shaft sealing rings in the gearbox housing and gearbox cover

Note:
All shaft sealing rings can be renewed with the gearbox installed, apart from the input-side shaft sealing ring on the input shaft.
If the gearbox is dismantled completely, all shaft sealing rings must be renewed.
Before installing shaft sealing rings, oil their sealing lips lightly.

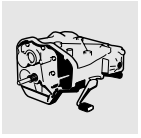
Renew the input shaft sealing ring at the input end

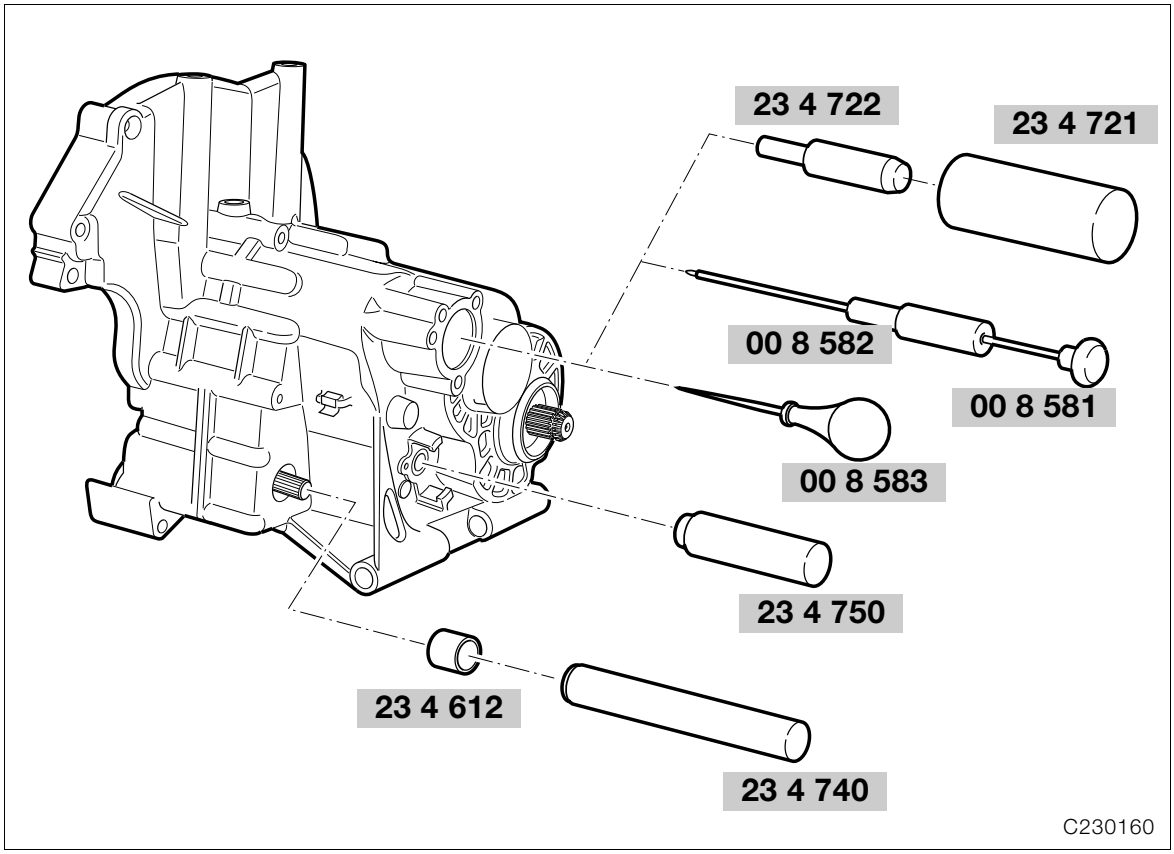
- Lever the shaft sealing ring out with a screwdriver.
- Drive the new sealing ring in with the sealing lips facing inwards, using slip-over sleeve, **BMW No. 23 4 712**, and drift, **BMW No. 23 7 711**.

Renewing output shaft sealing ring

Caution:
Never use a sharp tool to remove the output shaft sealing ring, or the plastic washer on the deep-groove ball bearing behind the shaft sealing ring could be damaged.

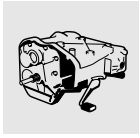
- Pull the shaft sealing ring out with puller, **BMW No. 00 8 590**.
- Install the sealing ring with the sealing lips facing inwards, using slip-over sleeve, **BMW No. 23 4 732**, and drift, **BMW No. 23 4 731**.





Renewing input shaft sealing ring at output side

- Pierce the shaft sealing ring with piercing tool, **BMW No. 00 8 583**.
- Screw the pull rod, **BMW No. 00 8 581**, into the pierced hole and use impact weight, **BMW No. 00 8 582**, to remove the shaft sealing ring.
- Install the new sealing ring with the sealing lips facing inwards, using guide pin, **BMW No. 23 4 722**, and impact driver, **BMW No. 23 4 721**.

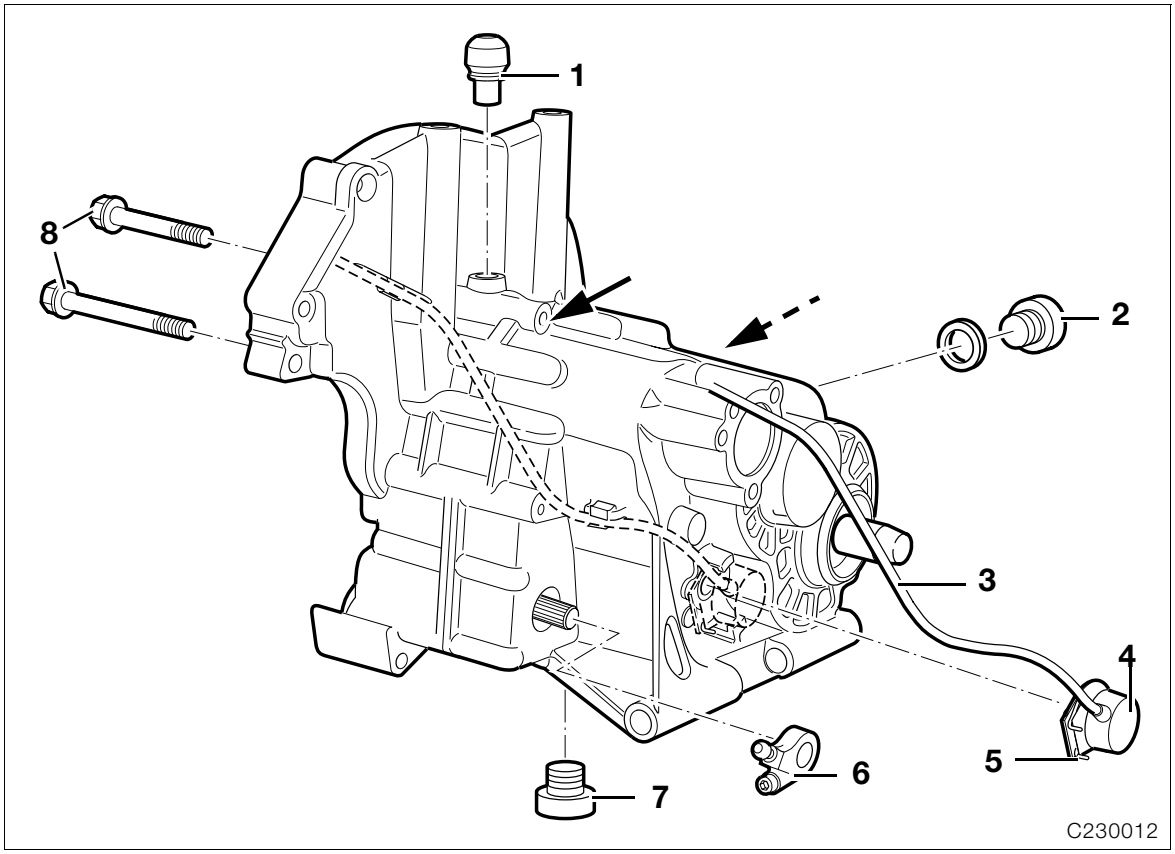


Renewing shaft sealing ring for selector drum

- Lever the shaft sealing ring out with a screwdriver.
- Install the new sealing ring with the sealing lips facing inwards, using impact driver, **BMW No. 23 4 750**.

Renewing sealing ring for selector shaft

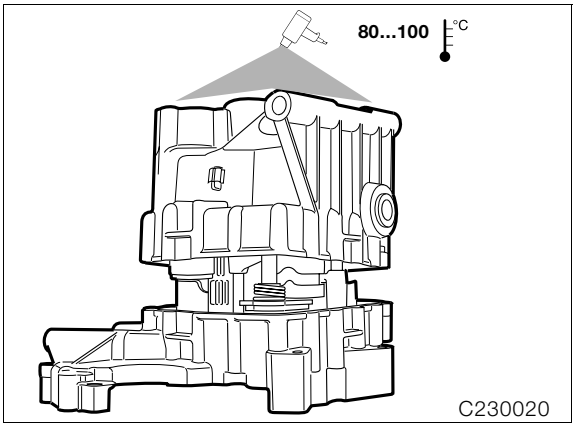
- Lever the shaft sealing ring out with a screwdriver.
- Install the new sealing ring with the sealing lips facing inwards, using slip-over sleeve, **BMW No. 23 4 612**, and impact driver, **BMW No. 23 4 740**.



Dismantling gearbox

Removing gearbox housing

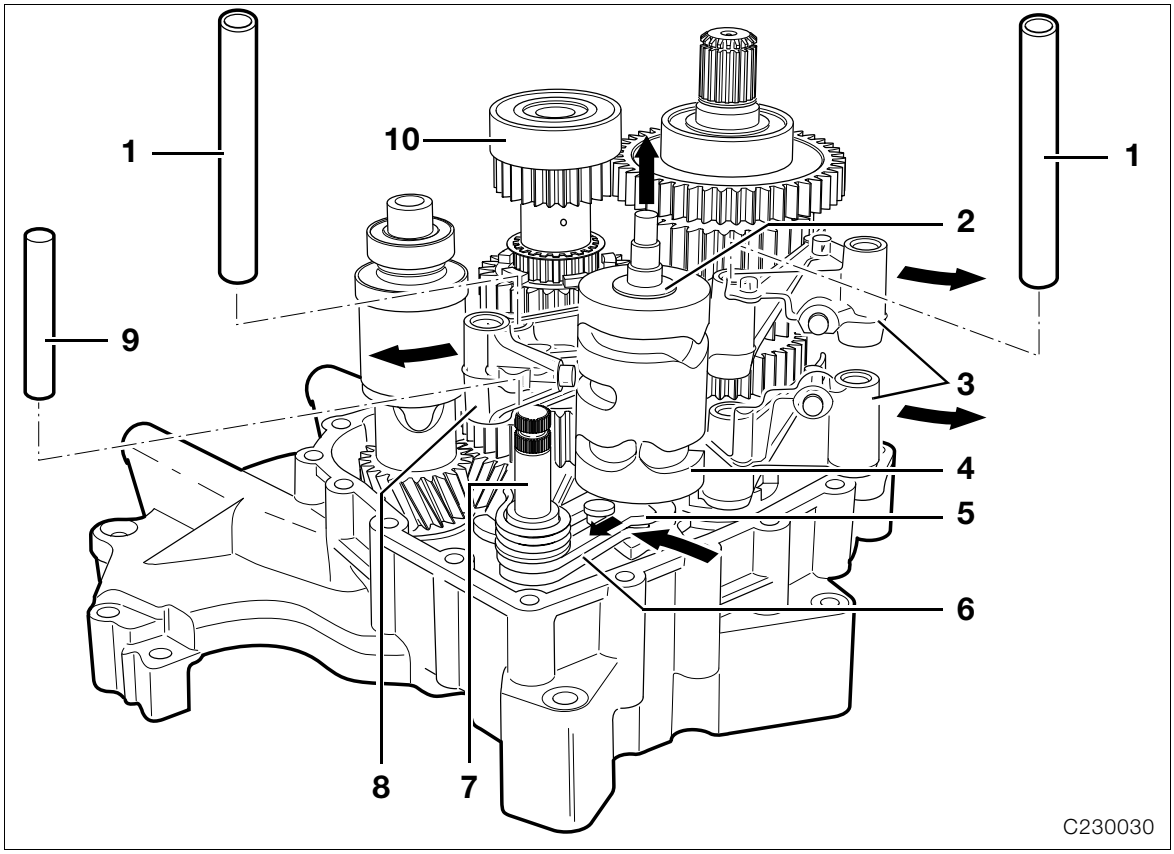
- Take out oil filler/level check screw (2).
- Take out oil drain plug (7) and drain the oil out of the gearbox into a suitable tray.
- Remove breather (1).
- Unclip cable (3) for neutral indicating switch (4).
- Compress spring (5) and take off neutral indicating switch (4).
- Remove selector lever (6).
- Carefully press back centering pins (arrows), working from the back of the gearbox.
- Remove screws (8) securing cover to housing.



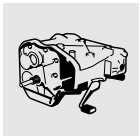
- Set the gearbox down on its cover.

⚠ Caution:
Avoid damage to the housing cover and painted surfaces.

- Heat the bearing points in the housing to 80 °C... 100 °C (176 °F...212 °F).
- Strike lightly with a plastic-faced hammer to release the gearbox.

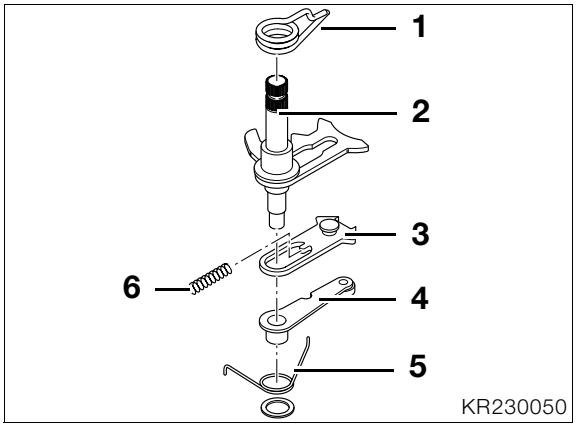


Removing selector drum

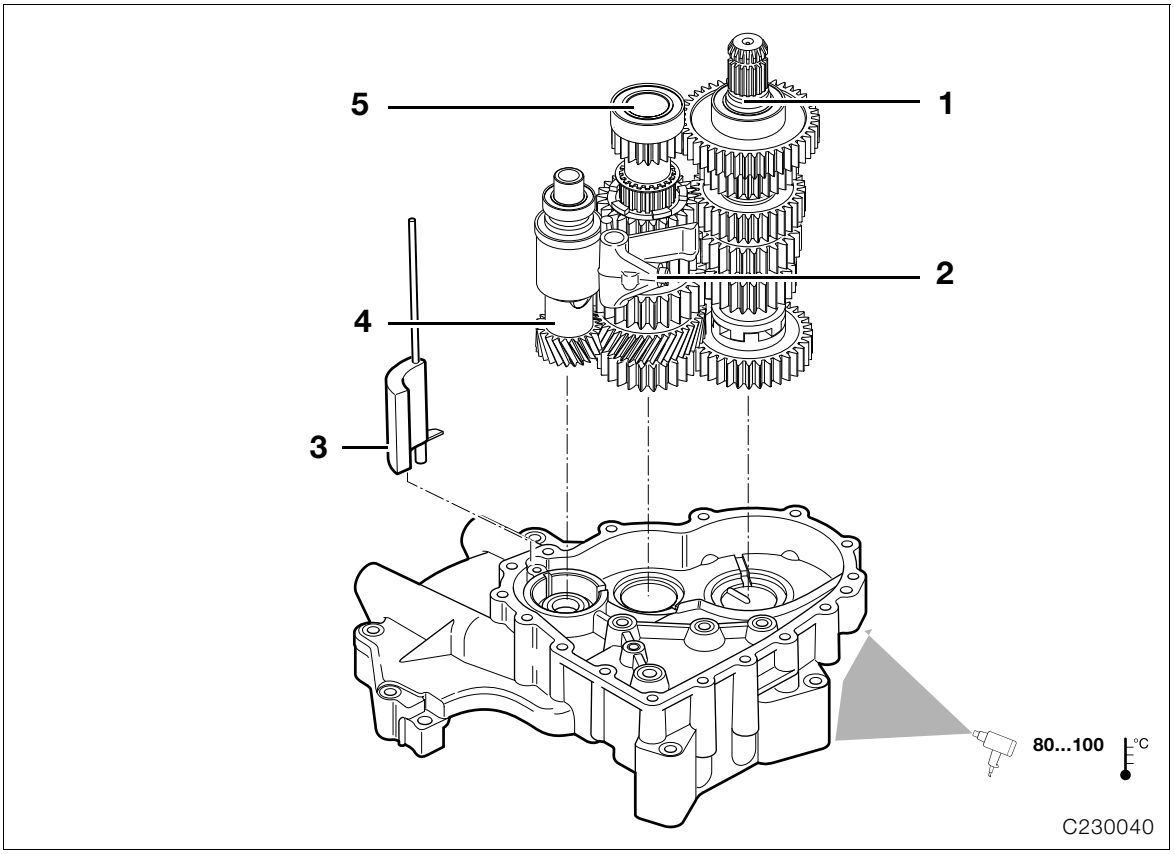


- Pull the selector shafts (1) out of the selector forks.
- Swing the selector forks (3/8) out towards the edge of the cover (arrows).
- Remove locking pin (9).
- Press guide plate (5) in the opposite direction to the spring loading (arrow).
- Swing locking lever (6) towards input shaft (7), hold it there and pull out the selector drum (4), turning it slightly at the same time.
- Remove the thrust washers and spacing washer.
- Release the locking lever (6).
- Remove the selector shaft (7) with spacing washer.
- Remove selector forks (3).
- Selector fork (8) remains in the intermediate shaft (10).

Dismantling/assembling selector shaft



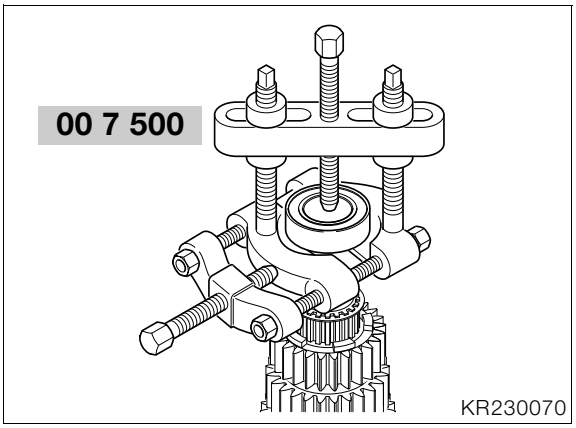
- Remove torsion spring (5) with locking lever (4) from selector shaft (2).
- Remove torsion spring (1).
- Remove coil spring (6) and take off together with sliding plate (3).
- Assemble in the opposite order of work.



Removing gearbox shafts

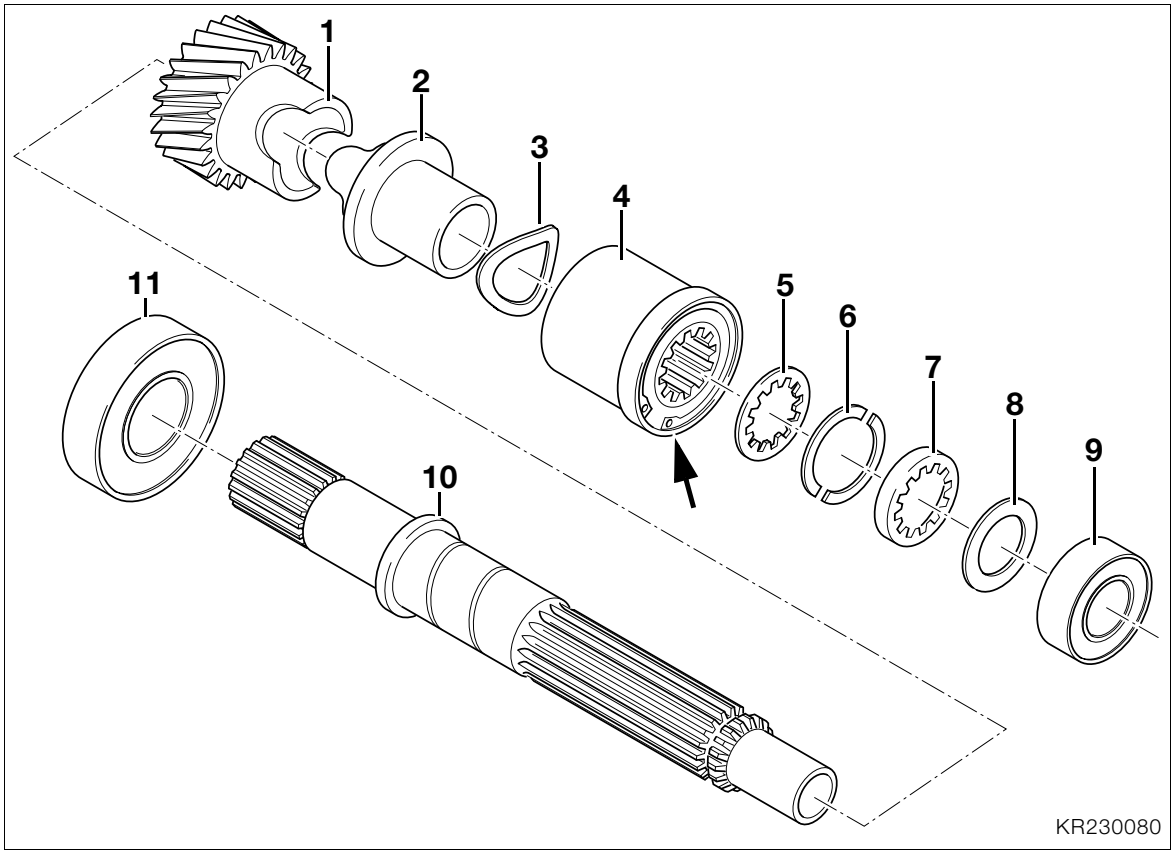
- Remove breather tube (3).
- Heat bearing points in gearbox cover to 80 °C ... 100 °C (176 °F ... 212 °F).
- Take off input shaft (4), output shaft (1) and intermediate shaft (5) together from the cover.
- Remove selector fork (2) from intermediate shaft.

Renewing deep-groove ball bearing on intermediate shaft



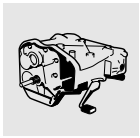
Caution:
If the deep-groove ball bearings are renewed, the fully-compressed length must be re-adjusted.

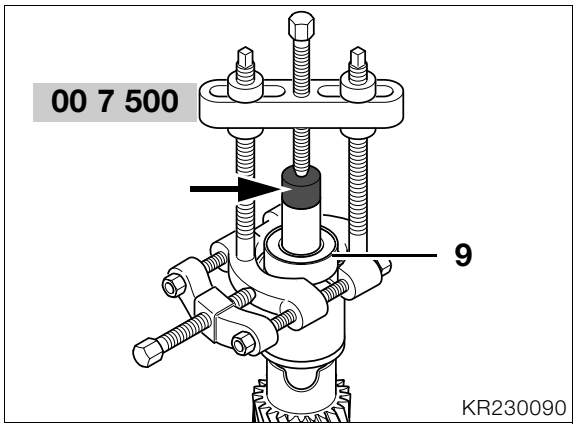
- Pull off the deep-groove ball bearings with a universal puller, **BMW No. 00 7 500**.
- Press the output-side deep-groove ball bearing on to the intermediate shaft.
- Check/adjust fully-compressed length (➡ 23.17).
- Place the spacing washer of the determined thickness in position and press on the input-side deep-groove ball bearing.



Dismantling/assembling input shaft

Dismantling input shaft





- Clamp the input shaft into the vise, using soft jaws.
- Use universal puller, **BMW No. 00 7 500**, and pressure head (arrow) to pull off deep-groove ball bearing (9) with spacing washer (8).
- Note the thickness of spacing washer (8).
- Remove guide ring (7).
- Compress spring cluster (4) and remove split segment washer (6).
- Remove support disc (5), spring cluster (4), anti-rattle disc (3), thrust block (2) and constant-speed gear (1).
- Transfer input shaft (10) to a different position.
- Use universal puller, **BMW No. 00 7 500**, and pressure head (arrow) to pull off deep-groove ball bearing (11).